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ENGINEERING ASPECTS OF TEXTILE STRUCTURES

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INTRODUCTION

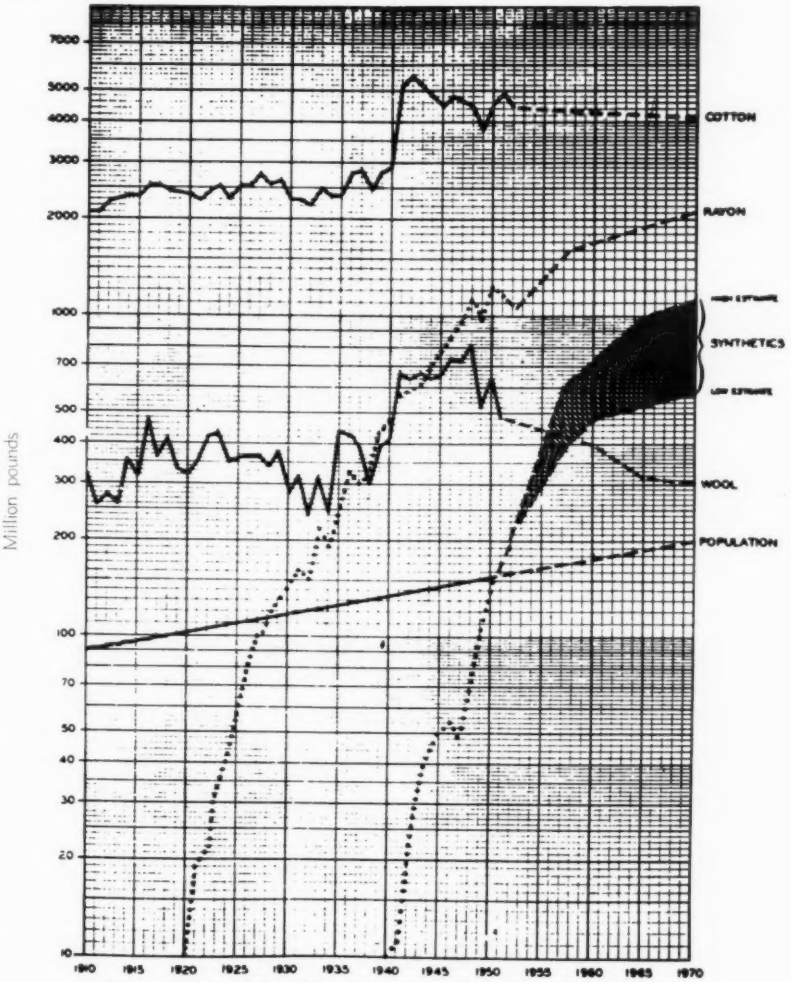
THE application of basic engineering concepts to the solution of problems which face mechanical engineers has long been recognized. Much of the fundamental data and formulas needed to work out problems of design and construction are readily available. Yet, although much has been said of the need for the application of sound engineering principles to the design of textile structures and the fruitfulness of such an approach, little has been done to capitalize on what is already known about textile fiber, yarn and fabric properties. Too often, the explanation is given that textile materials are too variable, too unpredictable, or too complex. To be sure, these materials *are* variable; they *are* also frequently difficult to predict; and certainly they *are* complex structures. But any material, be it steel, copper, cast iron, wood or concrete, is also variable, unpredictable and complex. Nevertheless, in spite of these characteristics, engineers have been working with these items for centuries and have employed engineering methods in their use.

The production of textile structures has often been called an art rather than a science. Admittedly, there is considerable art involved in dreaming up new colors, new patterns, and the latest fashion of garment either with or without hoops. It is contended, however, that the design of textile structures for specific end purposes is anything but an art. It involves defining the conditions under which the item will be used and then starting with the fiber, making a yarn, then producing a fabric. In some cases, yarns are never spun nor are fabrics woven, for a mat of fibers may serve the end use better than a fabric. Done properly, textile structures certainly are engineered.

* Presented before the ASME at Boston, Mass.

MATERIALS

As background to a consideration of textile fibers as engineering materials, it is interesting to review briefly the consumption of the more common fibers since 1910 and project what the consumption may be in 1970. Reference to Figure 1 indicates from a study by Arthur D Little, Inc *(1)* the relative position of the various fibers. It is obvious, of course, that the consumption



Source 1910 to 1951—USDA Statistical Bulletin 89 & Textile Organon
1952 to 1970—Arthur D Little, Inc projections

Figure 1
Consumption of Textile Fibers in US—1910 to 1970

of fibers has been increasing. Perhaps of greater significance is the more dominant role synthetic fibers as a group have been playing in the textile scene. This is particularly pertinent to this discussion because synthetic fiber properties can be controlled and can be altered to give a wide range of characteristics. This should not be disturbing, for engineers have been contending with this situation in metals since they were first used. Figure 2 shows the stress-strain properties of just a few well-known metals *(2)*. It will be noted that there is a wide variation in these properties. Ultimate strengths and elongations are widely different, yield points, elastic and plastic regions vary and, as a matter of fact, there are very few points of similarity. Multiply this selection of materials many times and some idea can be had of the myriad of metals that are available to the engineer for designing specific parts and structures.

Figure 3 reveals that there is at the disposal of a textile engineer a similar, wide variety of fiber properties from which a selection may be made for specific end uses. The extremes range from ramie, a high strength, low extensibility fiber with an almost linear stress-strain curve and an almost perfect elastic behavior over the entire range, to undrawn nylon which manifests a mechanical behavior nearly comparable with a perfectly plastic medium. Between these extremes lie fibers evidencing a wide variety of intermediate values of such important regions of the stress-strain curve as initial slope, yield region and post yield region. And additionally, all of these fibers as well as many more not shown can be made to vary depending on physical and/or chemical treatment.

VARIABILITY OF PROPERTIES

Most materials whether they be conventional engineering materials or textile fibers react differently when ambient conditions are altered. Figure 4 shows the change in the stress-strain properties of chrome iron with varying temperatures *(3)*. In general, as the temperature increases, the moduli are reduced, yield points are lowered and the stress bearing capacity is reduced. With a knowledge of these characteristics, design problems can be anticipated. Similar studies *(4)* have been conducted on textile fibers and Figure 5 shows such an experiment. In this instance, the entire testing machine as well as the sample was placed in a cold room, and fiber properties were obtained and recorded at a remote station. According to our personnel, who conducted these experiments, the tests were harder on the subjects than on the samples. Fig-

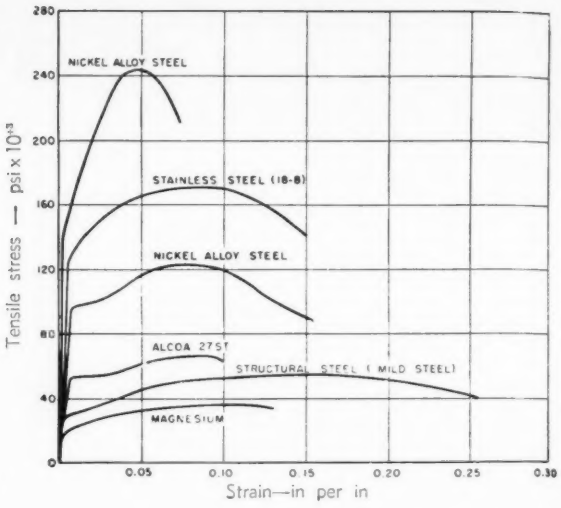


Figure 2
Stress-strain curves in tension

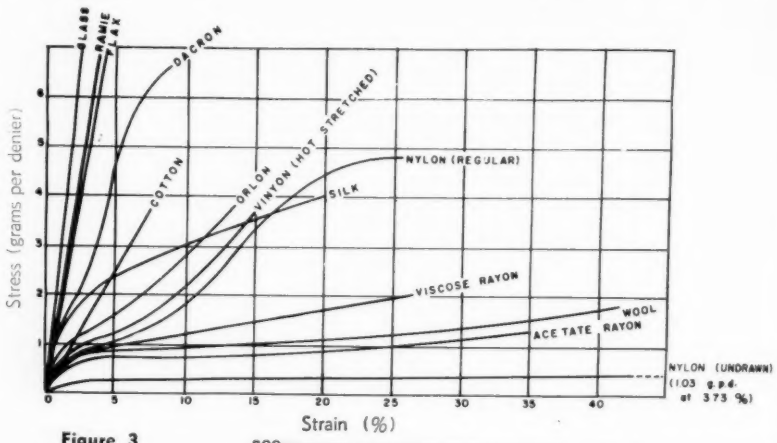


Figure 3
Stress-strain curves in tension

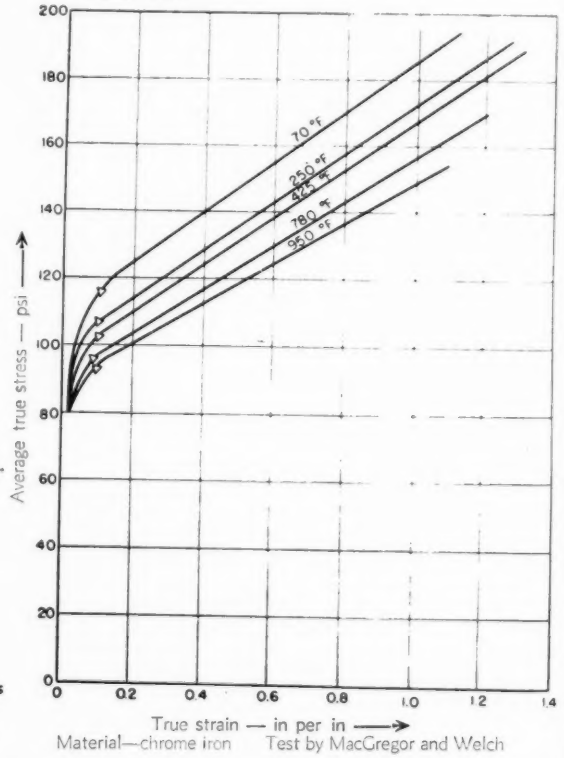


Figure 4
True stress-strain curves in tension at various temperatures (data from AIMME)

Figure 5
Laboratory Set-up — Low Temperature Tests

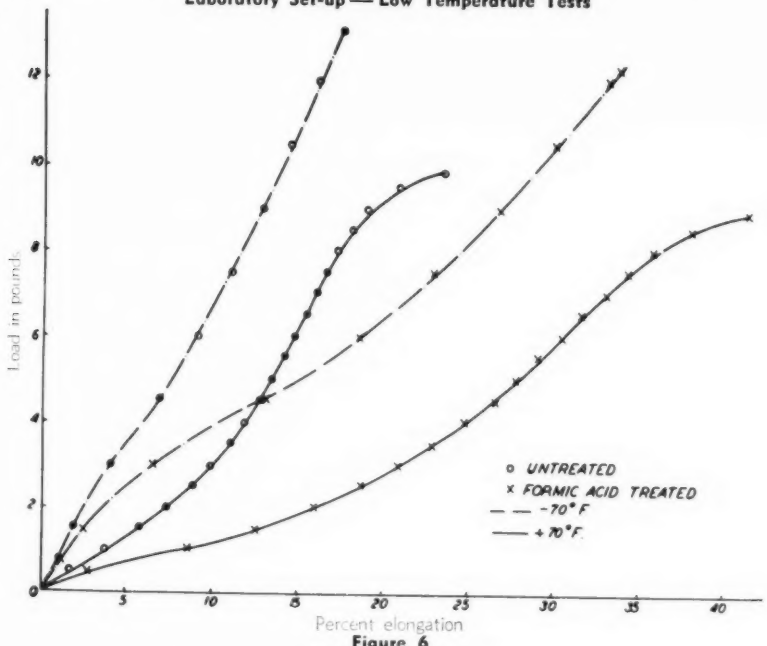


Figure 6
Nylon sleeve yarn
Load-elongation properties at —70°F and +70°F, 65% RH

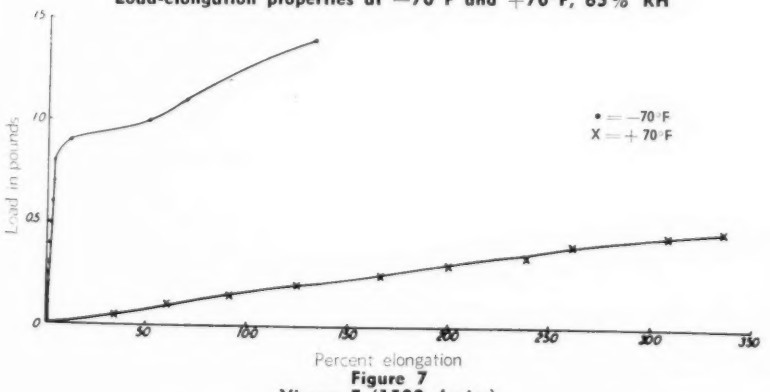


Figure 7
Vinyon E (1500 denier)
Load vs percent elongation at —70°F and +70°F, 65% RH

ure 6 indicates the change in nylon stress - strain characteristics when tested at +70°F and —70°F. A second set of curves shows the change in a formic-acid-treated nylon over the same temperature range. In general, as the temperature is decreased, the ultimate strength is higher, the ultimate elongation is reduced and the energy absorbing capacity is increased. Figure 7 indicates the change in properties of Vinyon E over the same range of temperature. These data are shown because of the interesting transformation. Vinyon E at essentially room temperature flows out quite readily and its energy-absorbing capacity is low but at —70°F the fiber has a much steeper initial portion of the curve and displays a rather well defined yield point. Under these conditions the material has greatly increased energy-absorbing power. Undrawn nylon exhibits similar transformations with a 372% elongation at 70°F but only 16% at —70°F.

Rate of loading certainly has a bearing on how materials behave. This situation is well known when dealing with metals and Figure 8 indicates how the stress-strain properties vary as the speed of loading is increased *(5)*. Figure 9 shows how nylon behaves when the rate of strain is increased from 12 inches per minute to 30 feet per second *(6)*. With greater differentials in speed, even more startling differences can be noted. The change in the impact properties of nylon is one of the reasons why this fiber lends itself so well to such items as flak suits and body armor vests.

It is well known in the metal industry that cold and/or hot drawing can very markedly alter physical properties. Figure 10 shows the effect of fabrication upon medium carbon steel *(7)*. With cold working, tensile strengths are higher, yield points are elevated and safe working ranges increase. Similar methods are used in the production of textile fibers. Years ago, cotton tire cord was greatly improved by use of wet stretching methods and the synthetic-fiber industry today realizes some of the desirable properties built into these synthetic fibers by use of drawing techniques. Figure 11 shows the stress-strain properties of a family of cellulose acetate yarns *(8)*. The unoriented fiber has a high elongation, low yield point and a relatively low tenacity. The change in properties from those of the unoriented materials as orientation is increased through the series 1 to 5 shows a large decrease in elongation, which tends to reach a limiting value and, at the same time, the tenacity increases enormously.

With the exception of the inorganic textile fibers, all fibers are hygroscopic. The same may be said for

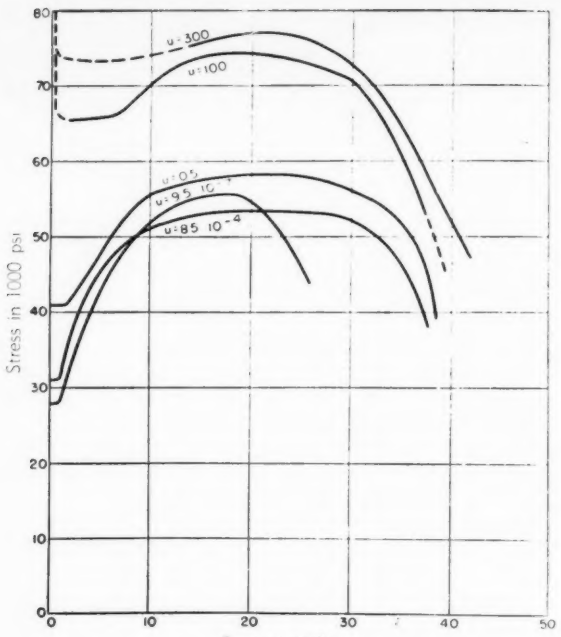


Figure 8
Effect of strain rate on properties in tension
(Courtesy ASME)

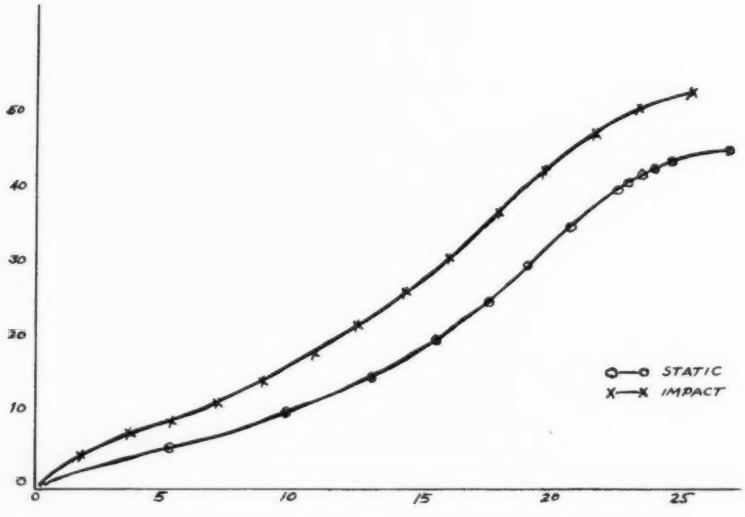


Figure 9
Load — % elongation curves, static vs dynamic
210/5/3 8S —6Z nylon shrunk 160°F, 30 minutes.

wood. Figure 12 *(2)* indicates how the load supporting capacity of wood decreases as the moisture content increases. Textile fibers react in a similar fashion and Figure 13 shows wet and dry stress-strain curves for keratin, and more specifically, human hair *(9)*. The wet sample has a much lower yield point and ultimate strength whereas the elongation at rupture has increased slightly.

Knowing something about the reactivity of textile fibers to moisture permits a more intelligent design of end-use structures.

Many more analogies can be drawn between the similarity in properties of conventional engineering materials and textile fibers but it is thought these few examples are sufficient to point out reasons why it is felt textile structures permit engineering as well.

ANALYSIS OF STRESS-STRAIN CURVE

It has been shown theoretically as well as empirically that, for such textile structures as wearing apparel, decorative fabrics and certain industrial uses, an analysis of the stress-strain curve at low strains in the range of 1 to 3 percent is pertinent *(10)*. Hence, the initial slope region of the curves is a potential region for investigation and should yield parameters useful in the design of textile structures.

It was pointed out earlier that the shape of the stress-strain curve for textile fibers was dependent upon time, ie, rate of loading. If time, therefore, could be effectively eliminated, time-independent parameters could be obtained. This would permit the calculation of an immediate-elastic deflection as well as point out the method for isolating the delayed elastic deflection, which is recoverable with time, and also the permanent deformation, which is time-dependent but nonrecoverable. For purposes of this discussion, comments will be confined to consideration of the time-independent parameter, ie, immediate-elastic deflection.

A fundamental relationship which is of great importance and value in the study of mechanics of materials is the ratio of total stress to elastic strain, namely, the modulus of elasticity. For materials which are effectively time-independent below the yield point, the calculation is simple. However, for visco-elastic materials, such as textile fibers, other methods must be employed.

An effective instrument known as the "Pulse Propagation Meter" *(11)* permits measuring the modulus of elasticity in essentially zero time. Through the basic relationship of pulse velocity through a specimen and specific gravity of the material, the modulus can be calculated. The instrument triggers pulses at the rate of 160 pulses per second and these pulses are transmitted to the specimen by means of a piezoelectric crystal. The time for an individual pulse to be propagated a given distance through the specimen to a receiving crystal is precisely metered by the device which autographically produces a diagram relating propagation time to either stress or strain as the specimen is loaded in a tensile-testing machine. Thus, with velocity of longitudinal pulse propagation through the specimen determined by the meter the modulus of elasticity or its reciprocal, the compliance may be readily determined by a simple formula.

Figure 14 is illustrative of typical load-strain and load-compliance dia-

grams for single fibers of hair, wool and acetate rayon *(10)*. Since the two diagrams are produced simultaneously for each fiber, they may be compared directly in the analysis of deformation components. The load-strain curves depict the total deformation corresponding to a given load while the load-compliance diagrams afford a means of determining the immediate elastic deflection at any load. This is accomplished by integrating with respect to load the area under the load-compliance curve. This has been done for a wide variety of fibers and is shown in graphical form plotted against total elongation in Figure 15. A perfectly elastic material would be located on the one-to-one line at any selected strain and the more nearly the fiber curves conform to this datum line, the more perfectly elastic would the fiber properties be. It is interesting to note that mohair, wool, Dacron and silk show very well in this regard and these fibers are known to be traditionally good in elastic properties. Perhaps a clearer manner to show these relationships is to calculate the ratio of the immediate-elastic deformation to the total deformation at the various strains. This ratio may be regarded as a "deformation index of elasticity" since it sets forth the extent of perfect elastic response of the fibers as a percentage of the total deformation suffered. Obviously, for a material which manifests perfect elasticity, ie, immediate and complete recovery upon removal of stress or strain, the deformation index of elasticity would have a value of 1.0. Figure 16 shows the same fibers as Figure 15 but plotted using the deformation index of elasticity as the ordinate. Note again how well the traditionally elastic fibers show to advantage.

An analysis such as this permits evaluation of fiber properties which are important in such more subtle characteristics as resiliency, hand, drape, wrinkle resistance, wrinkle recovery and the like. Many more similar analyses can be made but are beyond the scope of this paper.

APPLICATION OF STRESS-STRAIN CURVES

In addition to the fiber evaluations shown possible by use of the stress-strain curve, there are many other applications involving yarns and fabrics *(12)*. This applies not only to homogeneous and unidirectional systems but also to systems where different fibers and/or yarns are used in applications where stresses are multidirectional. Fiber blending is a typical example. It is well known that there are many reasons why different fibers are blended which include both economic and performance factors. Frequently, these factors are interrelated as the more expensive fibers generally can command a premium because of outstanding characteristics in certain end uses. And while fiber blending encompasses many properties which are not directly related to stress-strain properties, nevertheless, the stress-strain relationships ultimately enter the picture to a major extent. Although tensile strength *alone* is a property that has been given prominence much beyond its true significance, it is interesting to analyze fiber blends by use of the stress-strain curves and determine the resultant strengths.

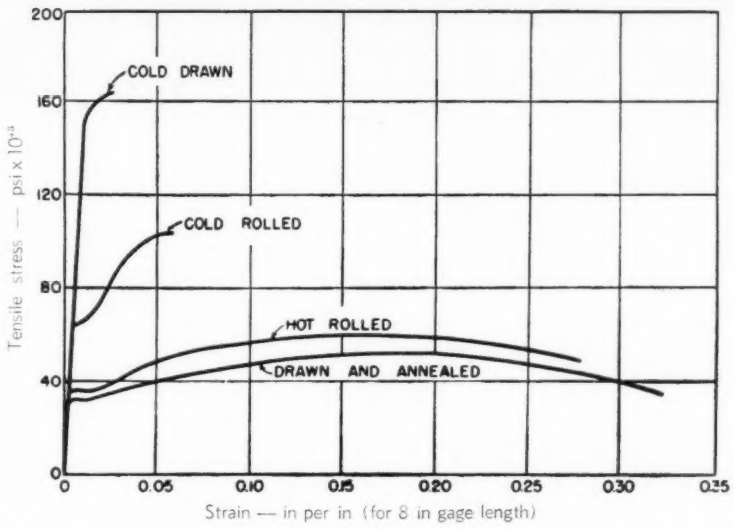


Figure 10
Influence of fabrication upon the stress-strain relations for medium carbon steel. (after G Murphy, "Properties of Engineering Materials", 1947. Courtesy International Textbook Co)

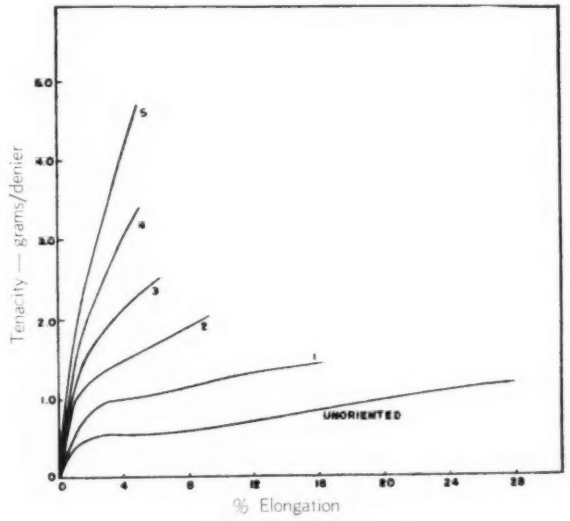


Figure 11
Effect of orientation of cellulose acetate yarn

Consider that a blend is to be made of two fibers, A and B, which have the following properties:

Fiber A
Ultimate tenacity — 5 grams/denier
Ultimate elongation — 3 percent

Fiber B
Ultimate tenacity — 9 grams/denier
Ultimate elongation — 6 percent

Assume also that the stress-strain curves of both fibers are concave upward as shown in Figure 17. If a yarn comprised of fibers A and B is D denier in size and if a is the percentage of material A by weight and b is the percentage of material B by weight, then

and

$$D_a = \frac{a\,D}{100}$$

$$D_b = \frac{b\,D}{100}$$

Where D_a is the total denier of material A and D_b is that of material B.

For the first rupture point 1 (failure of material A), the total load supported by the composite yarn is:

$$P_1 = P_{A1} + P_{B1}$$

but from the curves

$$P_{A1} = \frac{a\,D}{100} \times 5$$

and

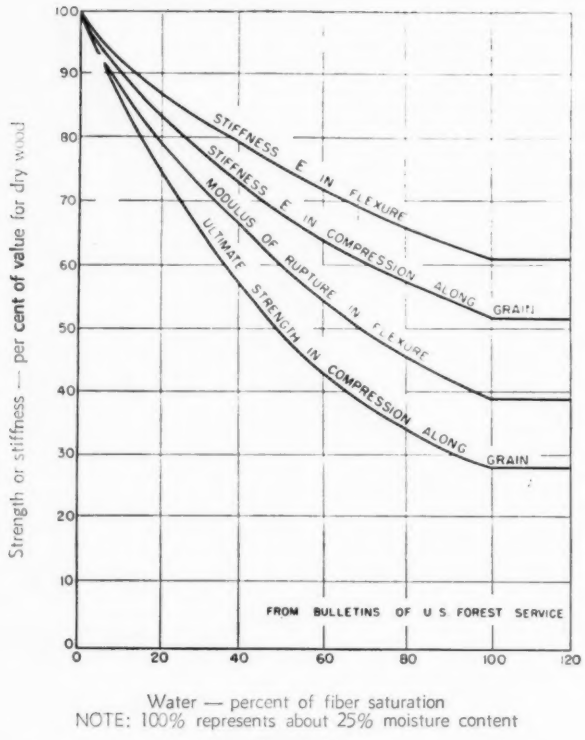

Strength or stiffness — per cent of value for dry wood
STIFFNESS E IN FLEXURE
STIFFNESS E IN COMPRESSION ALONG GRAIN
MODULUS OF RUPTURE IN FLEXURE
ULTIMATE STRENGTH IN COMPRESSION ALONG GRAIN
FROM BULLETINS OF U S FOREST SERVICE
Water — percent of fiber saturation
NOTE: 100% represents about 25% moisture content

Figure 12
Effect of moisture on strength and stiffness of softwoods

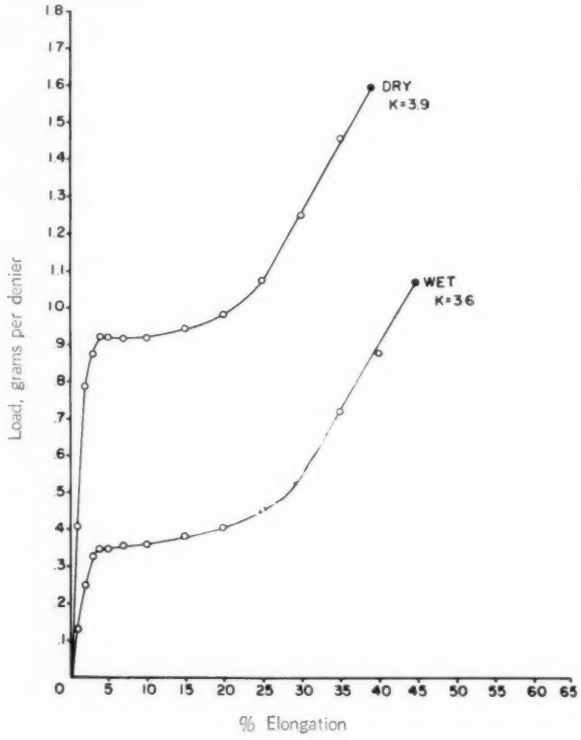


Figure 13
Effect of moisture on load-elongation properties of human hair

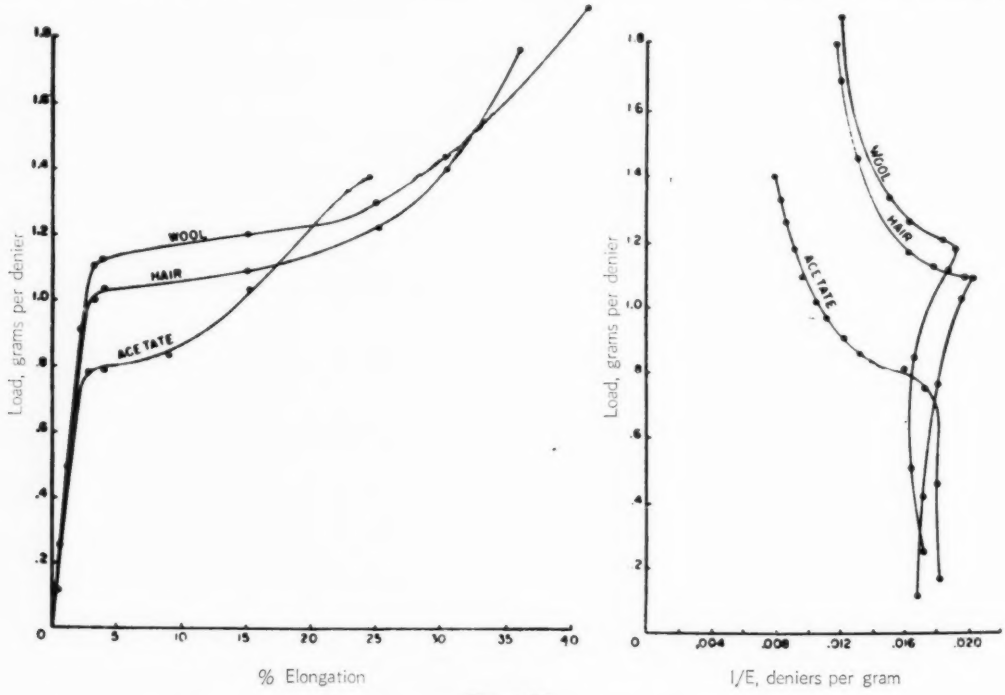


Figure 14
Load-elongation and load-compliance curves for wool, hair and acetate rayon

$$P_{B1} = \frac{bD}{100} \times 2$$

therefore

$$P_1 = \frac{D}{100}(5a+2b) = \frac{D}{100} 5a+2\,(100-a)$$

$$= \frac{D}{100}(3a+200)$$

$$= 2 + \frac{3}{100}(\%A) \text{ grams/denier}$$

In the same fashion, at second rupture point B (failure of material B), the load supported by the composite yarn is:

$$P_2 = 9 - \frac{9}{100}(\%\ A) \text{ grams/denier}$$

Graphically, the relationship of blend strength versus blend by weight is also shown in Figure 17. It will be noted that up to blends of approximately 40% of the stronger fiber B, the strength of the blend at the final rupture has decreased and it is only until 55.5% of fiber B has been added that the composite yarn strength at first rupture equals the strength of a yarn composed entirely of the weaker fiber A.

Consider, now, a blend where fibers A and B have the same ultimate tenacities and ultimate elongations as the former case, but the stress-strain curve for fiber B is concave downward. See Figure 18.
In this instance,

$$P_1 = 8 - \frac{3}{100}(\%\ A) \text{ grams/denier}$$

and

$$P_2 = 9 - \frac{9}{100}(\%\ A) \text{ grams/denier}$$

Referring to the blend strength—blend weight chart, and in contrast to the previous example, as fiber B is added to the blend, the composite strength curve increases continuously and all blends of these two fibers will be stronger than a yarn composed entirely of weaker fiber A. It is rather obvious that, not only are the ultimate strengths and ultimate elongations important to consider in blending fibers for strength, but more important is the relative shape stress-strain curves.

Another example of the application of stress-strain curves can be found in the analysis of a parachute shroud line. Shroud lines in general consist of a round braided sleeve or cover with a central core. It is apparent that if the composite structure is subjected to load, the individual components (cover and core) must share their respective share of the load imposed.

If a braid were constructed with no particular consideration to balancing ultimate elongations, the following data taken from an actual example could result. See Table I (poor elongation balance). The composite strength is only 350 lbs and represents a strength efficiency of about 78%.

If, on the other hand, an attempt were made to balance elongations (good elongation balance) a much higher composite strength of 477 lbs would result. The strength efficiency is approximately 95%.

Consider, now, an example where a fabric is subjected to stresses which are multidirectional. Light weight, plain weave fabrics of silk, nylon and Fortisan were constructed and fin-

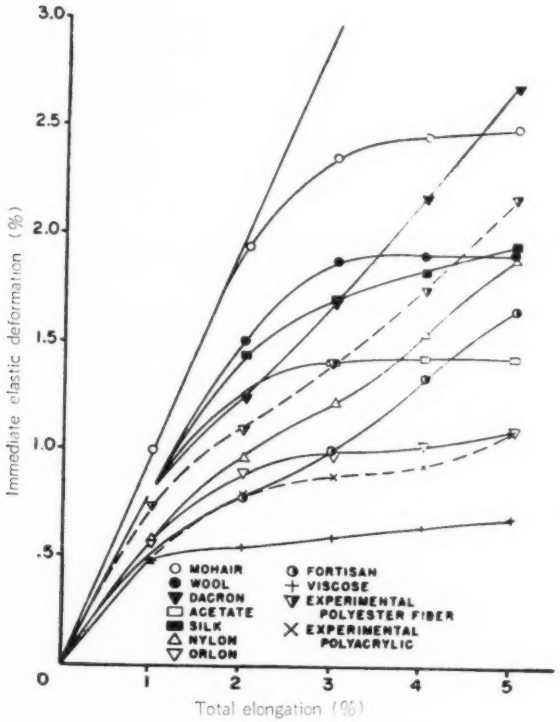


Figure 15
Immediate elastic properties for several fibers

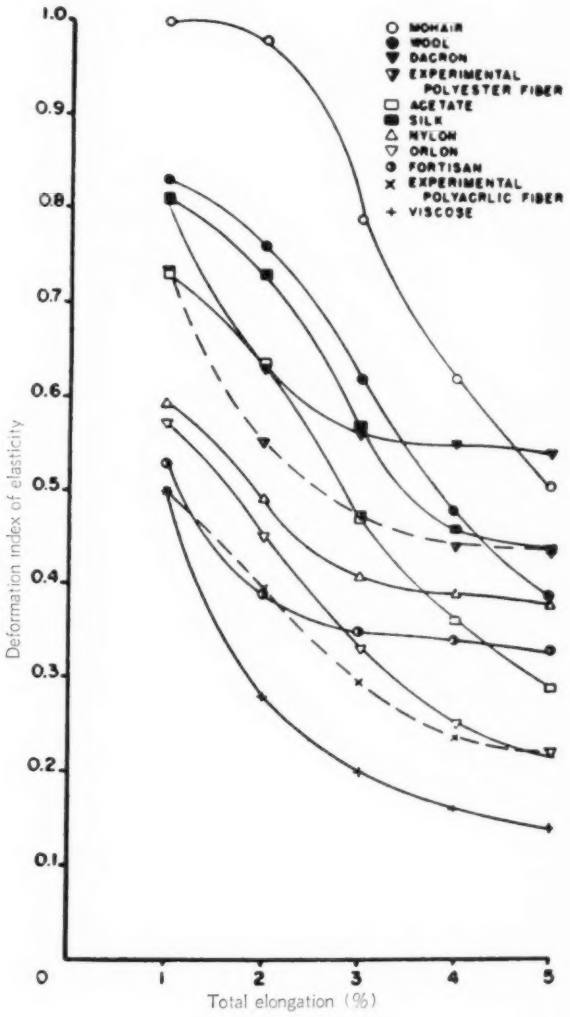


Figure 16
Deformation indices for several fibers

TABLE I
Parachute Shroud Line

Poor Elongation Balance

	Breaking Load –lbs.	Elongation at Rupture (%)
Core	250	15
Cover	200	30

Composite strength 350 lbs

Good Elongation Balance

	Breaking Load (lbs.)	Elongation at Rupture (%)
Core	268	36.5
Cover	235	37.9

Composite Strength 477 lbs

ished in such a manner that their warp and filling strengths and elongations yielded the data shown in Table II. The fabrics were subjected to bursting tests and the results are also shown.

A review of the data indicates no correlation between strength results and bursting strength; however, there is a definite correlation between elongation balance, warp to filling, and bursting strengths. The high bursting strength of the Fortisan would be expected due to the excellent warp and filling elongation balance. In the case of the Fortisan ruptured sample, all the yarns both warp and filling were broken while in the case of the silk and nylon, the system of yarns having the lower elongation remained essentially intact. Obviously, here, as in the case of the braid, the maximum potential strength of both structural elements is lost due to lack of elongation balance between warp and filling.

CONCLUSION

To those of us who have been close to the textile industry the last few decades, it must certainly be recognized that our industry is truly a dynamic one. Not too long ago, the textile designer had but a few fibers from which to select his raw materials. Now he is confronted with a wide selection encompassing a correspondingly great diversity in physical and chemical properties. Additionally, methods of processing have become more varied and versatile. Processes which once were limited to rather confined fiber lengths now have their

TABLE II
Parachute Fabrics

	Silk	Nylon	Fortisan
Warp, Tensile	41 lbs	79 lbs	76 lbs
Filling, Tensile	46 lbs	70 lbs	68 lbs
Warp, Elongation	20%	19%	7.6%
Filling, Elongation	14%	25%	7.6%
Bursting Strength	172 lbs/ sq in	168 lbs/ sq in	206 lbs/ sq in

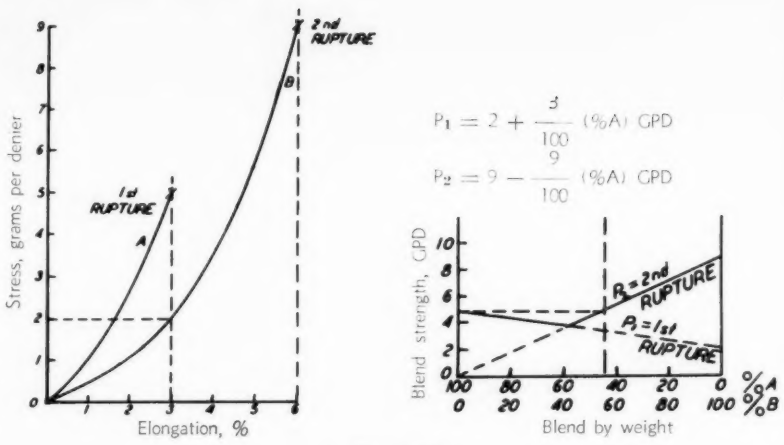


Figure 17
Effects of stress-strain characteristics on blend strength

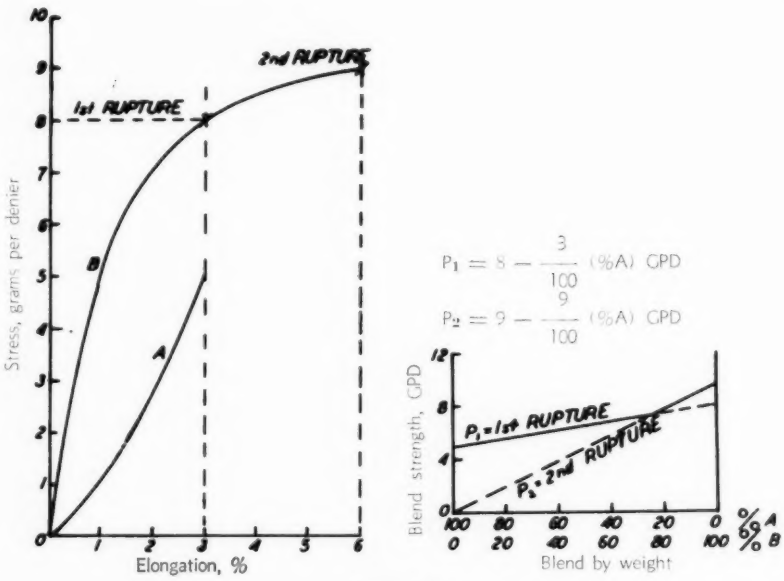


Figure 18
Effects of stress-strain characteristics on blend strength

range of usable fiber staples greatly increased. Yarns are being spun from staple fiber with little or no twist, fabrics are no longer being woven in the conventional manner, and the use of mechanical and chemical treatments in finishing are more diverse and effective than ever before. And even more important, the surface has hardly been scratched.

It is anticipated that new fibers will be developed that will combine the desirable features of the synthetics with what are still outstanding properties in the natural fibers. Molecular blends of cellulosic and protein constituents are already available in experimental samples. Synthetic fibers no doubt will some day be produced which will simulate the felting qualities of wool. The fields of electrostatics and hydrodynamics will be used for controlling the placement of fibers. The tremendous possibilities of automation will be realized in the textile mills of tomorrow. Certainly the future textile industry offers breathtaking opportunities for the scientist, engineer and textile designers.

The late Harold DeWitt Smith recognized the inevitable need of a sound engineering approach to the design and utilization of textile structures when he commented in his Marburg Lecture of 1944 *(13)* "... an engineering approach to the design and utilization of textile fibers, yarns and fabrics

(Concluded on page 346)

Proceedings of the
American Association of Textile Chemists and Colorists

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MAY 21, 1956

Future Papers

Manuscripts of the following papers, all of which have been presented before local sections of AATCC, have been submitted to date to the publishers of American Dyestuff Reporter. Subject to the approval of the AATCC Publications Committee, all will appear in the Proceedings in future issues.

Authors and Section Officials are requested to inspect this list, and notify the publishers if there are any omissions.

"Use of Silicones in the Textile Industry"—Robert A Ford, Dow Corning Corp

"Colorimetric Evaluation of Color Gradients in the Woolen & Worsted Industries"—Roland E Derby, Jr, The Derby Co, Inc

"The Application of Vat Dyes to Acrilan and to Acrilan Rayon Blends"—Edgar D Smith and Walter H Hindle, The Chemstrand Corp

"Practical Interpretations of the Results of Laboratory Investigations in the Field of Vat Printing"—Maurice R Fox, Arnold, Hoffman & Co, Inc and Imperial Chemical Industries Ltd

"Chemical Considerations of Woolen and Worsted Finishing"—Herbert C Haller, S Stroock & Co, Inc

"Some Aspects of the Newly Developed Crypto-Anionic Surface-Active Agent"—H G Seifert, Sandoz Chemical Works, Inc

"Hibulk Acrilan"—S Jack Davis, The Chemstrand Corp

"Arnel Triacetate—Its Properties, Applications and Dyeing Characteristics"—A F Tesi, Celanese Corp of America

"The Dyeing and Related Processing of Nylenka"—Ross M Stribling, American Enka Corp

"Cotton Textiles: An Over-Capacity Industry?"—W E Clark, U S Rubber Co

"Cotton Finishing"—Hector C Borghetty, Rohm & Haas Co

"Arnel—1956"—Fred Fortress, Celanese Corp of America

"Factors Influencing the Successful Application of Direct Dyes"—E M Taylor, General Dyestuff Co

"Textile Chemical Specialties—The Magic Skin"—Mark Weisberg, Eltex Chemical Corp

"A Study of Wash and Wear Cottons"—Charles R Williams, Monsanto Chemical Co

"Aesthetic Standards in Textile Print Designs"—D D and Leslie Tillett, House of T Fabrics

"Wash and Wear Finishes on Cotton Fabrics"—Hector C Borghetty, Rohm & Haas Co

"Wash and Wear Fabrics"—E W Lawrence and R H Phillips, Cranston Print Works Co

AATCC Calendar

COUNCIL

June 15 (New York); week of Sept 10th (New York, N Y); Nov 16; Jan 18, 1957

NATIONAL CONVENTIONS

Sept 13-15, 1956 (Waldorf-Astoria, New York) (as part of the Perkin Centennial, Sept 10-15); 1957 (Boston); 1958 (Hotel Conrad Hilton, Chicago); 1959 (Washington, D C)
delphia, Pa)

HUDSON-MOHAWK SECTION

June 22 (Annual Outing)

MID-WEST SECTION

June 16 (Outing—Browns Lake Resort, Burlington, Wis)

NEW YORK SECTION

June 22 (Outing—North Jersey Country Club, Wayne Township, N J)

NORTHERN NEW ENGLAND SECTION

Sept 28 (Annual Outing—Wachusett Country Club, West Boylston, Mass); Oct 19 (Science Park, Boston, Mass); Dec 1 (Annual Meeting—Hotel Vendome, Boston)

PHILADELPHIA SECTION

May 25 (Annual Outing—Huntingdon Valley Country Club, Abington, Pa); Sept 28 (Abraham Lincoln Hotel, Reading, Pa); Nov 2 (Drake Hotel, Philadelphia, Pa); Dec 7 (Kugler's Restaurant, Philadelphia, Pa)

PIEDMONT SECTION

June 8-9 (Outing—Mayview Manor, Blowing Rock, N C); Oct 6 (Annual Meeting—Hotel Charlotte, Charlotte, N C)

RHODE ISLAND SECTION

May 25 (Ladies Night, Sheraton-Biltmore Hotel); June 15 (Annual Outing, Pawtucket Country Club); Oct 18 (Johnson's Hummocks Grille); Dec 6 (Annual Meeting, Johnson's Hummocks Grille)

SOUTH CENTRAL SECTION

June 22-23 (Lookout Mountain Hotel, Chattanooga, Tenn); Dec 1 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

June 8-9 (Outing—Radium Springs, Albany, Ga); Sept 22 (Columbus, Ga); Dec 8 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

June 15 (Outing—Wallingford Country Club, Wallingford, Conn); Oct 15 (Annual Meeting Hartford, Conn); Nov 16 (Rapp's Restaurant, Sheltcn, Conn)

Employment Register

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56-5

Education: Dyeing and finishing graduate.

Experience: Chemist, supervision, technical service. Work simplification, correspondence, etc.

Age: 38; married; references; desires position in sales, production or laboratory. Prefers Mid Atlantic or New England. 5-7, 5-21

56-6

Education: B S, Chemistry and dyeing.

Experience: Textile chemist

Age: 23; single; references; position as textile chemist desired, research or technical service, vicinity of New York City. 5-21, 6-4

56-7

Education: Graduate of college night course in chemistry.

Experience: Superintendent of dyeing and finishing specializing in tricot.

Age: 47; married; references; position in supervision of dyeing or finishing desired, South or West. 5-21, 6-4

56-8

Education: College graduate, Spain, industrial chemistry; year at Massachusetts Institute of Technology in chemical engineering.

Experience: textile chemist, USA and presently Spain; publications in Spanish

Age: 32; single; references in USA; position desired in New England or in Central or South America, chemist or sales. 5-21, 6-4

Washington Section ——

NEW TEXTILE PRODUCTS FROM PLASTICS*

GEORGE A FOWLES

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U S Department of Commerce
Washington, D C

The author calls attention to the fact that, in some 4000 years, there was comparitively little development or improvement in the basic "friction" concept with regard to the manufacture of textile products. However, the change in this situation was sudden and drastic with the development of nonwoven fabrics.

This paper presents a summary of the nonwoven fabric picture today along with predictions as to the immediate and long-range future.

FOR over 4,000 years manufacturers have depended upon friction to hold textile products together. In a loose sense, woven fabrics could be likened to a pile of twigs which tend to hold themselves together in random placement by the friction engendered among interlocking branches. In textiles, such interlocking friction is naturally much improved upon through spinning and weaving processes. While this is an oversimplification, the analogy illustrates generally the relatively inert state of the textile art up until recently. In some 4,000 years, there has been comparatively little development or improvement in this basic friction concept with regard to textile products. Chemists have developed new fibers and designers have created various new end products, but, by and large, the billions of yards of fabrics made each year were still spun and woven.

The change in this situation was sudden and drastic. The development of nonwoven fabrics through the combination of fibers and plastics has revolutionized the manufacture of many textiles in the last few years. These new materials have experienced rapid growth in certain fields during the last ten years and have excited great interest. In this period, nonwoven fabrics jumped from practically nothing to about 1 percent of all fiber consumption in the United States. This may seem small, percentagewise, but volume is 50 million pounds of fabric. It is difficult to estimate what this means in yards because nonwoven yards may vary from 1 mil to several hundred mils in thickness, and producers are naturally reluctant to reveal specific production figures.

Last year over 55,000,000 pounds of nonwoven fabrics were produced from many types of fibers. Generally, nonwoven fabrics are mats of fibers held together with a bonding agent. These mats may be formed on many different types of machinery from practically any type of fiber, and a multitude of bonding agents may be used—ranging from rubber, to adhesives, or plastics, depending upon the kind of end product and end use desired. The designer of nonwoven fabrics must plan and design his product carefully, choosing from a great variety of materials to obtain the properties he wishes to develop.

Because of the technical research effort required, producers of nonwoven fabrics have spent a larger percentage of their sales dollar in development work than has been usual in the past in the textile industry. Good planning is all-important, especially with respect to interesting the ultimate consumer in the many new applications and ideas available. For example, not too many years ago, ladies' undergarments were reinforced with wire hoops or stiffly starched and laboriously ironed, in order to obtain a specific styling. In addition, lace and other colorful materials were used for their visual effect. Now these styles, effects, and physical characteristics may be obtained in one simple material, made of nonwoven fabrics. These materials may be washed without losing pleats and will retain their resiliency and springiness probably longer than the wearer cares to use them. They may be made in a multitude of colors and weights to obtain practically any desired effect. Other less glamorous applications of the nonwoven materials include shoulder pads, reinforcing materials in men's suits, and built-in belts in ladies' clothing.

Research and progress in new applications for nonwoven fabrics has led to the development of many new ideas and simplified constructions. In industrial usage, some of these new ideas have resulted in appreciable cost savings and product improvements. The prize example of cost saving in using nonwoven fabrics is the modern interior automobile door panel. Such panels are fabricated without any sewing and without any labor other than laying the individual pieces together prior to heat-sealing the overall assembly. The modern door panel is constructed of a stiff fiber-board backing plus a bulky nonwoven fabric to obtain a cushioning effect, on top of which is laid a fabric which actually may again be a nonwoven material, coated with vinyl resins and embossed and colored to obtain the desired interior trim. These three pieces are laid together in a heat-sealing press and sealed together in a matter of seconds. The result is a luxurious automobile interior in modern quilted form, so much in demand by stylists.

By the elimination of sewing and a multitude of cutting and trimming operations, not only have very appreciable cost savings resulted but many new possibilities have become available to the designer in the use of a much stronger and more wear-resistant fabric. Deletion of the sewing operation means no threads to tear out or rot out. The vinyl-resin wearing surface, which is easy to keep clean and may be washed without fear of staining or rotting, will retain its attractiveness for the average life of the car.

This basic concept offers many uses in other textile fields as well as a variety of new opportunities. Because the heat-sealing technique may be similarly employed in incorporating vinyl sponge or foam in a textile product, the nonwoven fabric can readily serve as the backing material or coating base in many luxury applications. Furniture, upholstery, luggage, bath mats, and even book covers may be made soft and resilient, and

(Concluded on page P336)

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New York Section ——

PRACTICAL ASPECTS OF DYEING IN THE BURLINGTON BEAM MACHINE*

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In this paper the operation and economic features of processing in the Burlington machines are described. Much progress has been made in handling goods of varied constructions and it is fully expected that further research will yield improved methods for dyeing many of the fabrics which now impede liquor flow through the beam package. Throughout the discussion the advantages of the Hy-Press machine for dyeing the new synthetic fibers and blends of these with natural fibers are emphasized.

INTRODUCTION

THE principles of dyeing yarns in package form and in warp beams have been known for many years. Vat-dyed cotton warp yarns are used extensively for colored stripes, checks and solid shades. Much of the dyeing is carried out on perforated section beams and the dyeing process is entirely analogous to package dyeing. The size of the beam package varies from 400 to 600 ends of ten to fifteen thousand yards depending on the yarn count, weighing from 100 to 300 pounds.

Early in the development of nylon tricot and marquisette fabrics in ca 1943 a group of men recognized the value of beam-dyeing machines for economical production and set about to develop a horizontal beam machine for this purpose. The unit became known as the Burlington beam-dyeing machine (*1*), manufactured by the Burlington Engineering Co, Inc, Graham, N C. Soon it was established throughout the trade as the most satisfactory machine for dyeing fabrics of open or loose construction, such as marquisettes, ninons and tricot knit materials. Many mills adopted it for dyeing cotton, rayon, acetate, and nylon fabrics a number of years before emphasis was placed on high-temperature dyeing at elevated pressures. In the open machine, operated at atmospheric pressure, the following advantages were found over conventional beck dyeing of fabrics, such as tricot:

1) Increased production (4,000 yards or more in one operation)
2) Elimination of costly tacking operation
3) Elimination of rope creases
4) Elimination of chafing

This machine was also used for boil-off, bleaching, and scouring. In such procedures, as well as in dyeing, one-way flow of liquor is circulated inside-out through the fabric.

DESCRIPTION OF MACHINES

Two distinct types of Burlington units have been produced:

1) Rectangular
2) Cylindrical or Hy-Press machine

Two different rectangular machines have been manufactured. Each consists of a rectangular tank with rounded bottom but the most recent rectangular machine is fitted with a lid or cover, which is bolted to the kier so that dyeing can be conducted at elevated temperatures and pressures. A perforated beam on which fabrics are wound is immersed in the tank. Beam sizes may be varied to fit specifications. The beam is first wrapped with a few layers, about one-inch thick, of openly constructed cotton muslin or cheesecloth or Type 81 Orlon acrylic filament, depending on the dyes being applied. This serves as protection against perforation marks and as a cushion to allow shrinkage of certain fabrics. The wrapping cloth should be 8 to 10 inches longer on each end than the cloth to be dyed.

The material to be dyed is delivered from a McCreary batcher or from a short tenter frame onto the beam, care being taken that the fabric extends two to three inches beyond the perforations of the beam.

Some goods, such as nylon or acetate tricot, are first run through a wet-out tank at 120 to 200° F over tension bars and then onto the beam.

An outer wrapping should be placed over the material on the beam and this should extend about 18 inches beyond the fabric to be dyed. Beam bands or collars of stainless steel are then fitted over the ends of the outer wrapping to hold it securely in place. After the bands are installed, the outer wrapping is sewn to the inner wrapping, using six- to eight-inch stitches. Sufficient water to cover the beam is added to the tank and the pump started and run five minutes. This is necessary to eliminate air from the pump and lines, as air pockets trapped in the goods can cause lightly dyed areas. The beam is then placed in the machine.

The goods are dyed with the machine open or closed. Usually, one-way flow, inside-out is used for dyeing under the boil as with disperse dyes on acetate or nylon. In this case the machine is left open. When dyeing is conducted at elevated temperatures, up to 235° F in the rectangular unit, the lid is bolted on securely. Although it is possible to employ two-way flow, it is common practice to use one-way circulation, inside-out. When operations are performed at high temperatures under pressure, adds are made through a special sampling and add kier attached to the main tank.

The cylindrical unit, known as the Hy-Press machine, is of sturdier construction, capable of withstanding up to 50 pounds steam gauge pressure, corresponding to 300° F.

This unit consists of a horizontal, cylindrical autoclave in which the beam is inserted and the door of the autoclave is bolted into place. Water is added to the 'clave and circulated for about five minutes after which chemicals and dyes are introduced from the make-up tank attached to the kier. Here again, a pressurized sample kier and add tank is available for adjusting dyeings during a run

* Presented before the New York Section on March 23, 1956.

NOTE: Duponol, Orlon, Pontamine, Capracyl, Sevron, Dacron and Avitone are registered Du Pont trade marks.

at elevated pressures.

It is stated that loads of 2 - 4,000 yards of open weave cloth or 1 - 1,500 pounds of knitted goods can be dyed in this machine. A fifty horsepower motor and pump supplies surprisingly good flow through relatively dense batches of woven fabrics, such as tropical suiting material.

DYEING OF SYNTHETIC FIBERS AND BLENDS

NYLON———Application of disperse dyes to tricot of acetate or nylon at 160 to 190° F is straightforward and simple. Disperse dyes on nylon do not emphasize nonuniformities in the fabric caused by physical or chemical irregularity of adjacent, individual yarns. However, the disperse colors often tail to meet end-use requirements of wash- and lightfastness. Acid colors, on the other hand, are suitable from the fastness standpoint, but they accentuate nonuniformities in broad-woven and tricot-knit fabrics of nylon.

A considerable degree of commercial success has been attained recently in the dyeing of nylon tricot at elevated temperatures, 235 to 250° F, in the Burlington machine using a new technique (2). Studies on the application of acid dyes show that acid colors can be applied with greatly improved levelness in a wide range of shades by employing Duponol D Paste surface-active agent, a long-chain fatty alcohol sulfate, in the dyebath. This agent functions in two ways: first, it minimizes the initial strike of the acid colors, and second, it brings about a marked increase in color transfer or leveling at dyeing temperatures of 235 to 250° F.

Table I illustrates the effectiveness of Duponol D Paste in promoting migration or transfer in typical acid dyed shades at 235°F. Combined sets of dyed and undyed fabrics were treated at this temperature with and without Duponol D Paste in a dye-free bath. Note the outstanding differences in transfer properties.

Table II illustrates the effect of temperature and Duponol D Paste on the levelness rating of a number of acid color shades dyed on a tricot fabric that was found exceedingly difficult to dye levelly at 200°F with acid dyes. Numerical ratings assigned to the test swatches indicate levelness obtained by the three application methods. A rating of 10 would indicate excellent levelness. A rating of 7 is of questionable acceptability. You will note a marked improvement in quality for dyeings made at 235°F with 2% of Duponol D Paste, in the middle column.

TABLE I
MIGRATION PROPERTIES

%	Dye	Comparative Transfer Properties at 235°F: Acetic acid only	Acetic acid + 2% Duponol D Paste
1.5 2.0	Du Pont Milling Red SWB conc 125% acetic acid, glacial	nil	good
1.5 2.0	Pontamine Fast Red 8BLX acetic acid, glacial	nil	good
1.5 1.2 2.0	Du Pont Anthraquinone Green GNN Du Pont Milling Yellow 5G Conc acetic acid, glacial	poor	good
0.25 .10 .02 1.0	Du Pont Anthraquinone Iris R Du Pont Anthraquinone Blue 2GA Du Pont Anthraquinone Green GNN acetic acid, glacial	good	very good

The procedure for dyeing nylon tricot with acid colors on the Burlington machine is as follows:

Batch the cloth on a cushioned beam.
Scour for 30 minutes at 180°F with
1.0 to 2.0% Duponol D Paste
0.5 to 1.0% antifoam agent
1.0 to 2.0% caustic soda
Overflow rinse.
Acidify with acetic acid.

TABLE II
EFFECT OF TEMPERATURE AND DUPONOL D PASTE ON LEVELNESS RATINGS

%		Duponol D Paste 190-200°F	Duponol D Paste 235°F	Acetic acid only 235°F
1.5 2.0	Du Pont Milling Red SWB Conc 125% acetic acid, glacial	5	7	4
1.5 2.0	Pontamine Scarlet 3B acetic acid, glacial	5	9	5
1.0 0.3 2.0	Pontamine Fast Red 8BLX Du Pont Anthraquinone Rubine R Conc acetic acid, glacial	5	9	5
1.5 1.2 2.0	Du Pont Anthraquinone Green GNN Du Pont Milling Yellow 5G Conc acetic acid, glacial	5	7	7
0.25 .10 0.2 1.0	Du Pont Anthraquinone Iris R Du Pont Anthraquinone Blue 2GA Du Pont Anthraquinone Green GNN acetic acid, glacial	6	7	4

Circulate 5 minutes and drop bath.
Dyebath contains
antifoam agent
2.0% Duponol D Paste
acetic acid (pH 4.5-5.0)
dye.
Dyeing is conducted preferably at 250°F for 1½ to 2 hrs.

Moiré is often encountered when dyeing dark shades on the beam machine. This can be reduced to an acceptable degree by prewrapping the beam with a one-inch pad of net or raschel knit fabric of Type 81 Orlon acrylic filament. This pad acts as a cushion and allows the tricot fabric to shrink with less pressure being exerted on the multiple layers of cloth.

In the laboratory Burlington machine, woven fabrics of nylon have been dyed with full loads of taffeta fabric weighing two to three ounces per yard. However, in the dyeing of five to six-ounce cloth, circulation is impeded by the denser package of heavier fabric. This effect is overcome in laboratory experiments by cobatching a layer of porous cloth, such as marquisette made of Type 81 Orlon filament, along with the nylon fabric.

Nylon tufted carpeting has been dyed successfully in the Burlington beam machine with Capracyl dyes (3). Excellent uniformity of shade and short dyeing cycle make this type of operation very attractive. The process is as follows:

Scour the carpet with ammonia at 212°F for 30 min.
Drop the bath and rinse.
Set the bath with (per 1,000 gallons):
1 gallon ammonium hydroxide (23%)
12 lbs ammonium acetate
10 lbs Capracyl Leveling Salt.
Raise the temperature to the boil and add dye.
Dye for 15 minutes at the boil.
Raise to 235°F and continue dyeing for 30 minutes.
Drop the bath and rinse.

ORLON ACRYLIC FIBER——Taffeta, unnapped fleece and shantung fabrics as well as various openly constructed fabrics, such as marquisettes made from Type 81 Orlon filament, have been dyed on a commercial basis in the Burlington machine. Chambray fabrics composed of Type 81 Orlon filament and cotton can also be dyed to produce a good range of shades with the Sevron cationic dyes on the Orlon component. The cotton component is then dyed with vat or direct

colors, depending on fastness requirements.

The fabric to be dyed is batched *dry* to medium hard density (40-50 Durometer hardness). An outer wrapping is particularly desirable in processing these fabrics. The amount of material which can be dyed in one operation depends largely on the resistance offered by the goods to the circulation of liquor; however, up to 1,000 yards of taffeta fabric have been successfully processed at one time.

On Type 81 Orlon filament a good range of pastel shades having excellent fastness is obtainable by applying the disperse dyes at 240° to 250° F. As previously mentioned, a good range of shades, possibly excluding full blacks, can be dyed with the Sevron colors supplemented by the selected older cationic dyes. Medium and heavy shades are also obtainable with selected acid colors applied at 240° to 250°F by the cuprous-ion method.

Fabrics made of 100% Type 42 Orlon acrylic staple or blends of this fiber with wool or cellulosic fibers are dyeable also on the Burlington machine. The dyeing temperature is limited to 230°F but there is no limitation of shade since Type 42 Orlon is so readily dyed in a full range with Sevron and older cationic dyes as well as with disperse and acid dyes. It is expected that the Burlington machine will be used extensively for Orlon and its blends with other fibers. Certainly the experience already obtained in dyeing blends of Orlon and wool on the Barotor using Sevron dyes will be directly applicable to dyeing in the Burlington machine.

DACRON POLYESTER FIBER ——Fabrics made of Dacron are usually subjected to a mild heat-setting treatment prior to batching on the beam. Tricot and other loosely constructed filament fabrics have been dyed commercially using the disperse colors at high temperatures, up to 250°F.

Carriers are not required when dyeing at 250°F. This applies to the filament form as well as Dacron staple.

Table III compares the costs per 100 lbs of fiber of three typical shades on the dyebeck with Dowicide A carrier versus Barotor dyeings at 250°F without carrier. Note the substantial savings in cost of dyes and chemicals when dyeing at high temperature. The Burlington machine exhibits the same advantages as the Barotor in this regard.

The most exciting application of the Burlington Hy-Press machine is the highly successful commercial dyeing in recent months of 50/50 blends of Dacron and wool worsted in tropical suiting weights.

TABLE III
COST OF DYES AND CHEMICALS FOR DYEING DACRON POLYESTER FIBER

	Beck*	Barotor	Savings
Gray	$7.79	$3.33	$4.46
Brown	30.87	19.47	11.40
Navy	54.08	40.24	13.84
Average saving for six suiting shades			7.66

* Includes $4.40/100 lbs for Dowicide A.

Eight-piece lots are batched in the wet state on a beam carrying a cotton marquisette cushion and an outer wrapping of the same material is also used. If necessary, the fabric may be boiled off (before dyeing) with detergent at about 200°F. The dyeing process for a light gray shade is as follows:

With circulation outside-in at 120°F, Capracyl Leveling Salt and neutral dyeing acid colors for the wool, including Capracyl dyes, are added.

After a circulation period of 5 minutes, the dyes for Dacron, previously pasted with Avitone T, are added. Circulation is continued for 10 minutes and then acetic acid is introduced. A small amount of carrier, 1.5% of trichlorobenzene type, is added. After 5 minutes further circulation outside-in, the flow is changed to inside-out. The temperature is raised to 200°F at about 1.5° per minute, at which point circulation is continued for 15 minutes and then 2.5% of formaldehyde and 0.5% of acetic acid (glacial) are added. The temperature is raised to 235°F and dyeing carried out for 45 minutes with inside-out circulation. After a sampling from the sample kier, one add of wool colors is made, in two portions, with the temperature at 212°F, running 15 minutes after the additions are made.

This dyeing was level throughout, with no evidence of tailing or cross shading.

TABLE IV
EXAMPLE OF DYEING CYCLE ON BEAM MACHINE

	minutes
At Loading Station	
Load beam	30
Unload beam	15
	45
At Autoclave	
Load beam, scour and rinse	45
Set bath and heat to 210°F	45
Close and heat to 235°F	15
Dye at 235°F	60
Sample, rinse and remove	45
	210

Similar dyeings have been made on this size batch in a variety of shades up to deep navies. The advantages are fairly obvious:

Lower dye and chemicals cost
Shorter time versus beck dyeing
Improved fastness to light, sublimation and solvent bleeding.

Two items in the dyeing procedure are of particular interest. First, a small amount of a relatively toxic carrier, a trichlorobenzene type, is used so that practical dyeing can be achieved at 235°F instead of 250°F. This is done to minimize wool damage even though the use of formaldehyde provides some protection. The carrier increases the rate of absorption of disperse dyes on the Dacron and promotes rapid transfer of these dyes from wool to the Dacron. Carriers other than trichlorobenzene are also effective; for example, Dowicide A. However, the trichlorobenzene type is handled quite safely in the closed Hy-Press machine and it is considerably cheaper than Dowicide A.

The second item has already been mentioned, namely, the use of formaldehyde to provide protection of the wool (*4*). Although it can be shown that 100% wool fibers may be adversely affected at 235°F for the length of time involved in this process, as judged by loss in abrasion resistance, there is little or no evidence of this effect in the blended fabric. Perhaps the explanation lies in the fact that the 50/50 blend of Dacron and wool is so highly resistant to abrasion. At any rate, this method of dyeing such blends is producing goods with excellent wearing quality and is obtaining confident trade reaction.

In order to lend further emphasis to an important advantage of this type of dyeing, a typical dyeing cycle on the Burlington machine is shown in Table IV. This cycle could easily represent the process just described for a blend of Dacron and wool as well as for 100% Dacron. In fact, it is believed representative of practical dyeing times for a variety of fibers and blends except those in which it is desired to cross dye or fill in the natural fiber on other equipment, such as a dyebeck or jig.

When it is remembered that commercial dyeing cycles on dyebecks for blends of Dacron and wool run as high as 12 to 15 hours for some shades, the Burlington machine is truly attractive.

ARNEL TRIACETATE FIBER ——A recent publication by Stoll (*5*),

describes the advantages of the Burlington Hy-Press machine for simultaneous dyeing, heat treating, and setting of tricot fabrics made of Arnel. The greige fabrics are scoured and given a pre-set in the usual manner in an open-width washer. After extraction they are framed onto the core of the Burlington pressure-dyeing machine. Width control and uniformity of wrapping on the beam are the most important factors in handling these fabrics. Optimum width depends on construction of the greige fabric and this must be determined experimentally. Care should be taken to avoid excessive stretching lengthwise or widthwise during the setting operation. Good overall fastness properties are obtained by employing selected disperse dyes.

MISCELLANEOUS DYEING PROCESSES

The Burlington machine has been employed successfully for various dyeing processes on a broad range of fabrics. Some examples are:

1) Pigment pad—Burlington machine development of vat dyes on cotton voiles, lawns and marquisettes.
2) Direct color padding (black)—Burlington machine development on rayon fabrics of open construction.
3) Vat dyeing and direct colors on rayon tufted carpeting.
4) Acid dyes on tufted wool carpeting.

ADVANTAGES AND DISADVANTAGES OF THE BURLINGTON MACHINE

In conclusion, the several advantages of the Burlington beam dyeing machine are listed as follows:

1) Ease of loading.
2) Economical yardage.
3) Shorter dyeing cycles.
4) Low investment cost.
5) Versatility as to dyeing, bleaching, heat setting.
6) Simple sampling device.
7) Low liquor volume and savings in steam and chemicals.

Disadvantages which are recognized include

1) Limitation to porous, loosely constructed fabrics.
2) Critical control of fabric width on the beam and wrapping devices.
3) Some limitation in redyeing of streaky goods — usually, loads must be reduced for good results.

ACKNOWLEDGMENT

The assistance of R J Thomas, J J Iannarone, G R Turner, L F Ryan and J A Brooks in developing data used in this paper is gratefully acknowledged.

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(3) Anon, Du Pont Textile Fibers "Technical Information Bulletin" N-29, October, 1955.
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(5) Stoll, R G, *Modern Textiles* **37**, 48, 1956.

QUESTIONS AND ANSWERS

Question: We have dyed some nylon taffeta on the Burlington-type unit and we have experienced some difficulty with tight selvages. What would you recommend in dyeing nylon taffeta to avoid tight selvages?

Answer: I haven't a good answer to that question. You should consider the construction of the fabric, the final width required, and how much stretching is given the fabric in batching it. Usually, tight selvages result from lengthwise stretching. I don't know of any other answer.

Q: Dr Meunier, you didn't make any mention of the filtration problem. I have never used that type of machinery you have described but in other pieces of equipment, working on the same principle, there has always been the problem of filtration, where the cloth acts as a filter. Have you any experience in reference to, for example, dirty water supply or something like that? Wouldn't the cloth, itself, act as a filter in that case, on the inner layers or the outer layers, whichever way you happened to be circulating?

A: Certainly filtration is observed whenever there is serious contamination of the water supply. I can best illustrate the effect, of course, by referring to some dyes which, if not properly dispersed, certainly will be filtered by the cloth on the beam.

However, considering only the disperse dyes at the moment, commercial experience would certainly indicate that good results can be obtained. I think a big improvement was brought about in the Burlington Machine design when the capacity of the pumps was increased, giving much better circulation through the fabric package.

Q: Dr Meunier, you have discussed the importance of going from scouring to dyeing, but at no time did you mention dropping the bath. In other words, it must always be in the liquid or liquid must always be present. You must never let the package, so-called, become dry. Is that absolutely necessary?

A: Yes, the pump should be kept running at all times. I did mention the dropping of the scouring bath. That has been done from time to time, but I think it is better policy to use overflow rinses and to keep the pump running.

Q: You were talking about acid dyes on nylon. Would you care to say what types of acid dyes? Were they like milling dyes?

A: They are selected from the milling, the neutral-dyeing, the premetalized-acid, and neutral-dyeing-acid types.

Q: You mentioned that the flow is always inside-out. I wonder, what with the heavy flow in the center of the package, and the outside of the package, whether there wouldn't be any difference in the absorption of the dyestuffs or swelling agents?

A: I'm not sure I understand your question but I'll make this statement and see if this answers it. I referred to inside-out circulation on the open machine. When you start up with the machine closed, in a high-temperature dyeing, it is desirable to start outside-in circulation and then reverse after the chemicals are in, and continue inside-out flow.

The principal advantage of this procedure is that it avoids pulsation in the pump and lines, which occurs when the direction of flow is alternated during the dyeing.

Q: While the machine is open, running the inside-out circulation only, the flow rate at the center of the machine is much higher than the flow rate at the outside. If you do that, let's say on yarn packages, you would get a build-up of color in the center to a greater extent than on the outside. How do you avoid that?

A: I think that is avoided by limiting the construction of the goods to more or less open weaves. That's one of the limitations at the present time. The goods must be openly constructed, to allow a good rate of flow through the package.

Q: You mentioned the dyeing of pile fabrics. Do you limit that to open machines or can it be done with both open and closed types?

A: I assume that you are referring to my comments on carpeting. I described the process for dyeing nylon carpeting at 235°F. However, there is no reason why you couldn't go higher. The machine could be left open, too, and dyeing could be carried out below 212°F.

(*Concluded on page P336*)

Rhode Island Section———

MICROSCOPICAL STUDIES ON WOOL DYEING: Preparation and Use of Longitudinal Sections*

HENRY E MILLSON
Organic Chemicals Division,
American Cyanamid Company,
Bound Brook, N J

A new technique is suggested for examining fibers by sectioning longitudinally. Microscopical examination of fibers by means of longitudinal and cross sections has proved to be a valuable tool in the study of the art of fiber processing and dyeing. The use of these sections provides means for examination of the interior structure of fibers. Such means have hitherto been unobtainable. By the proper application of these methods, it is possible to gain a better understanding of the changes which occur during the dyeing and chemical treatment of fibers.

INTRODUCTION

CROSS-SECTIONS have been used in many of our previous microscopical studies on the dyeing and treating of wool fibers (*1 to 9*). These cross-sections have provided valuable information on the penetration and diffusion of dyes and chemicals into wool fibers. However, cross-sections have certain limitations because they can provide only a limited view of the fiber.

Studies with the Microdyeoscope (*10*), in which wool fibers were mounted longitudinally have shown that chemicals such as hypochlorite, sulfoxylate and peroxide, which are used in wool processing, do not attack the fiber uniformly. Local variations are especially pronounced during the early stages of treatment. Other experiments using cross-sections have shown that, when a combination of several dyes is used, their rates of penetration and diffusion into the fibers are quite different. Therefore, when using a combination of dyes, it is a common occurrence to observe that one dye will have penetrated the fiber completely, while others are concentrated on or in its outer areas. The metalization of dyeings as viewed through the Microdyeoscope has also shown that chemicals penetrate the fiber in much the same nonuniform manner as dyes. Therefore, in the early stages of metalization, the dye in the outer areas of a wool fiber can be completely metalized while that in the center remains unmetalized (Figures 1 and 2).

The scales on wool fibers appear to play a complex role during the dyeing and processing of wool, but their function is not completely understood (*8*). When it is possible to obtain more specific information on the influence of the physical structure of wool on dye penetration, improved methods for batch and continuous dyeing can be devised.

These and many other studies have indicated the need for a method which would make it possible to examine larger areas of the interior of wool fibers than are obtained by an examination of cross-sections. It was believed that sectioning the fiber longitudinally would provide larger areas for such studies and reveal details which could not be obtained in any other way of the structure and the mode of penetration and diffusion of dyes and chemicals.

In the examination of a cross-section, one sees only points in a plane across a diameter of the fiber, ie, perpendicular to its axis. In a cross-section therefore, one sees in effect, the ends of an infinite number of thin longitudinal sections. Similarly, one longitudinal section shows, in effect, an infinite number of thin cut edges of sections. Cross and longitudinal sections can therefore be used to supplement each other and provide more intimate details of fibers than

Figure 1

2% Eriochrome Verdone A
3% Acetic acid 28%
10% Glauber's salt
Boiled 1 hour. Rinsed.

The dyed wool was immersed for 5 minutes only in a boiling bath containing 0.5% cobalt acetate. The dark areas on the outer parts of the fibers are the blue cobalted shade, while the light centers are the unmetalized pink shade.

* Kodachrome slides of this investigation were shown as part of a lecture on Microscopical Dyeing Phenomena to the Rhode Island Section of the AATCC in Providence, R. I., on January 28, 1954.

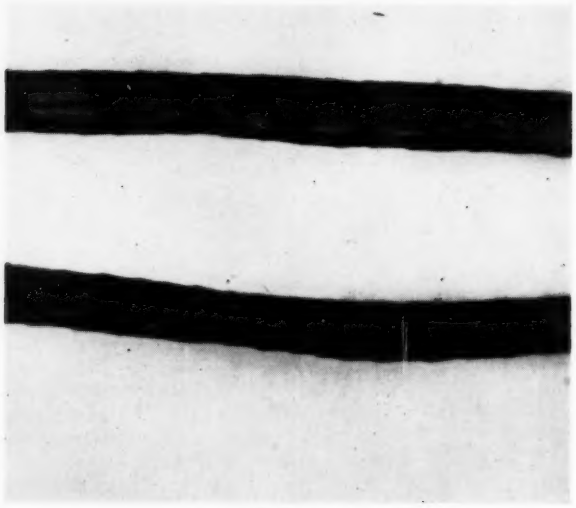

Figure 2

Longitudinal view of the same fibers as in Figure 1. Note the bicolored effect of partial metalization of the dye in the outer areas of the fibers.

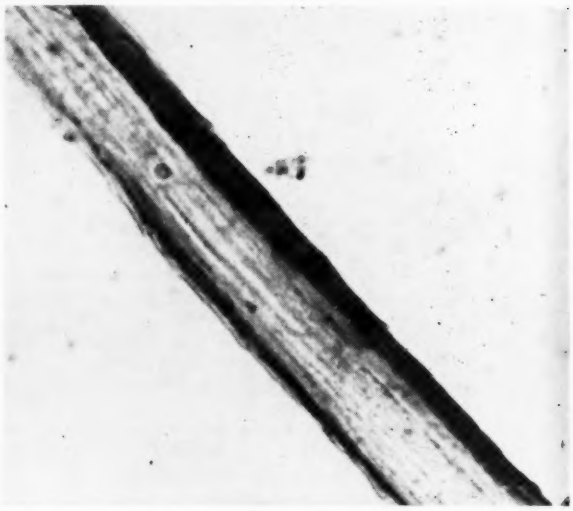

Figure 4

This is a longitudinal section of a fiber taken from the dyeing used for figures 1 and 2 showing the darker area of cobalted dye contrasting with the lighter unmetalized dye in the inner part of the fiber.

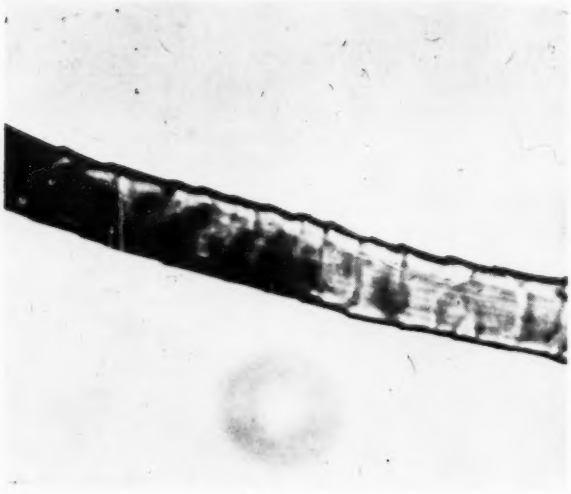

Figure 3

Longitudinal veiw of a wool fiber showing variations in dye absorption along the fiber

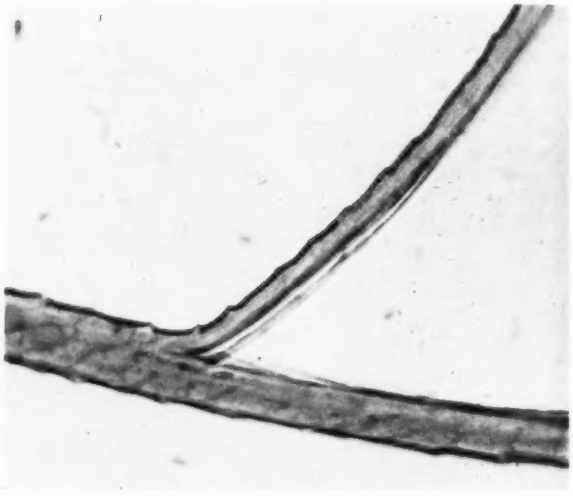

Figure 5

An East Indian wool fiber showing the longitudinal cut section still attached to the fiber.

are obtained by an examination of either one alone.

Most of the changes in physical condition and structure of wool fibers observed by the author have been seen along the length of the fiber. Examination of cross-sections of the same fibers gave little indication of the extensive changes which had occurred. For example, changes in scale structure caused by excessive chlorination or disorganization of the scale structure caused by prolonged exposure to light could only be seen by examination of fibers that had been mounted longitudinally. The geometry of the fiber itself indicates that observations should be made along its longitudinal axis in addition to the examination of cross-sections. When observations are limited to a study of cross-sections, the information obtained can be misleading because the penetration and diffusion of dyes within a fiber often vary considerably throughout its length. These variations in structure play an important part in dye absorption because they permit local diffusion of dye in one area while other areas of the same fiber may remain undyed (Figure 3).

Unless uncarded staples from fleece wool are used for cross-sectional studies, there is also the problem of having a random distribution of tips and body areas in the same cross-section. This can be misleading because, in the case of colloidal types of dyes applied by conventional methods, the tips will be heavily dyed while the body areas may be undyed or only lightly dyed.

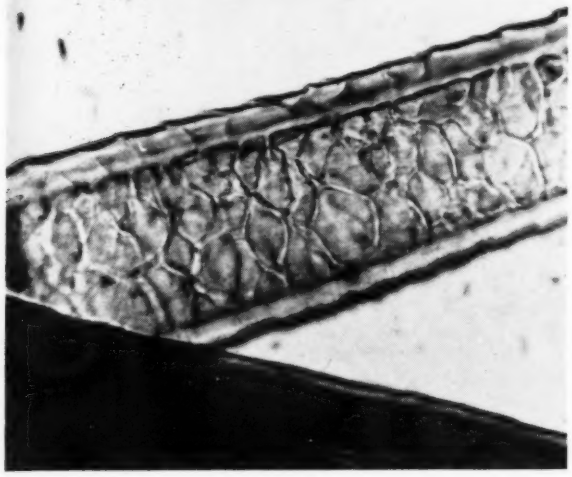

Figure 6

A large medullated East Indian wool fiber sectioned longitudinally. This section shows the apparent connections between the cuticle and the medullated interior.

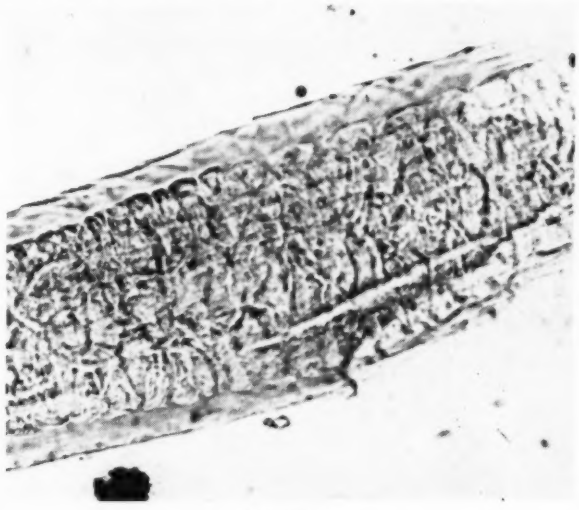

Figure 7

A Longitudinal section of an East Indian highly-medullated wool fiber which shows the manner in which the outer part of the fiber is attached to the medullated interior.

PREPARATION OF LONGITUDINAL SECTIONS

A comparatively simple method has been devised for the preparation of longitudinal sections. Coarse East Indian and other carpet wool fibers were used initially because of their toughness and comparatively large fiber diameter, although Australian 64s have also been sectioned successfully by this technique.

In the preparation of the sections, paraffin flakes are melted and poured into chilled plaster of Paris molds in which wool fibers have been fastened. When the paraffin has cooled, the block containing the fibers is removed from the mold. The sections are then cut parallel to the long axis of the fibers as thinly as possible using a new razor blade. The sections are then cemented to a glass slide by using an albumen fixative (soluble egg albumen dissolved in water with thymol added to prevent putrefaction). This is done by first rubbing a drop of the cement on the slide and removing any excess. The paraffin section is then placed on the slide and the slide is held over gentle heat so that the paraffin will soften and straighten but will not melt. The cooled slide is then placed in xylol which dissolves the paraffin, after which the slide is removed and the xylol evaporated. The sections are covered with diaphane and a cover glass put in place. The slide is then scanned with a microscope to locate satisfactory sections for study. When located, they are removed and remounted in diaphane for photographing.

This method has yielded good results on coarse fibers, but additional refinements are necessary before it will be entirely satisfactory for sectioning high-grade wools and other fibers of small diameter.

Several methods for producing longitudinal sections were tried but none gave results equal to the paraffin embedding method. An attempt was also made to mount fibers horizontally in a modified Hardy microtome slot by cementing with collodion and then sectioning longitudinally, but this method did not prove satisfactory.

EXAMINATION OF LONGITUDINAL SECTIONS

Photographs of a few of the sectional wool fibers are shown and described in detail to illustrate the appearance of the fiber and the kind of information it is possible to obtain from longitudinal sections. All fibers were dyed prior to sectioning.

Figure 4 shows a fiber sectioned longitudinally from the same dyeing shown in Figures 1 and 2. The concentration of cobalted color appears darker than the unmetallized dye in the center of the fiber. This is a nonmedullated wool fiber and shows longitudinal striations within the cortex.

Figure 5 is a photograph of a typical longitudinal section showing both sections still attached. The fiber is East Indian carpet wool and was dyed top chrome with 3% Calcochrome Fast Red ECB (*CI* 652) prior to sectioning.

Figure 6 shows a longitudinal section of a medullated East Indian fiber. This section shows the interior area of the fiber and reveals apparent connections between the cuticle or scale area and the medulla. The dark area in the lower left-hand corner is the top portion of the fiber and shows the scale structure.

The East Indian wool fiber shown in Figure 7 was dyed top chrome with 2% of Calcochrome Blue Black Conc (*CI* 202). This section shows a very large medullated area and also the manner in which the outer part of the fiber is attached to the interior.

Figure 8 is a photograph of a Scotch Blackface wool fiber showing an uncut area adjacent to a longitudinally sliced section. The examination of several sections reveals extensive medullation, which is not so apparent in the uncut section. When examined through the microscope, the normal or uncut area of the fiber appears to be uniformly colored. However, microscopical examination of the sectioned area shows nonuniform distribution of the dye within the fiber. The outer part of the fiber is more heavily dyed than the interior portion and the intensity of color varies considerably in local areas along the fiber. The medullated portion of the fiber appears to be undyed or only lightly colored. The fiber was dyed top chrome with 2% of Calcochrome Fast Red ECB.

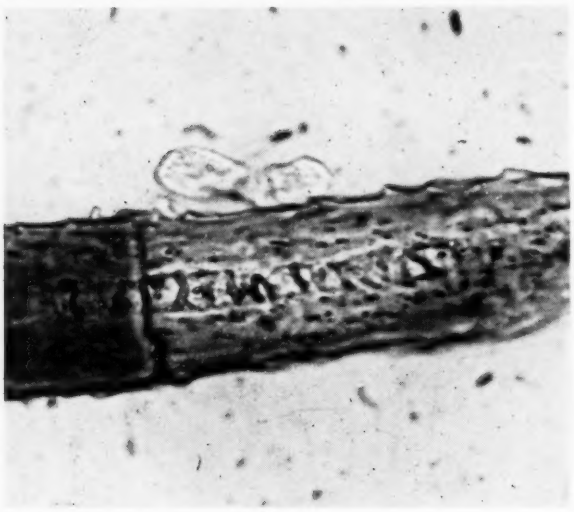

Figure 8

A photograph of a Scotch Blackface wool fiber showing uncut and sectioned areas. Longitudinal sectioning reveals extensive medullation which is not so apparent in the uncut area. The sectioned area exhibits wide variations in uniformity of coloration which is not observed by examination of the uncut area.

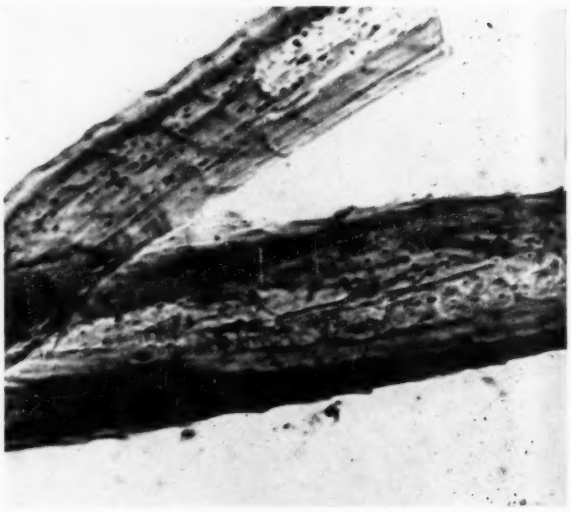

Figure 10

An East Indian wool fiber mounted so that the top section is raised to reveal the interior. Medullation is apparent.

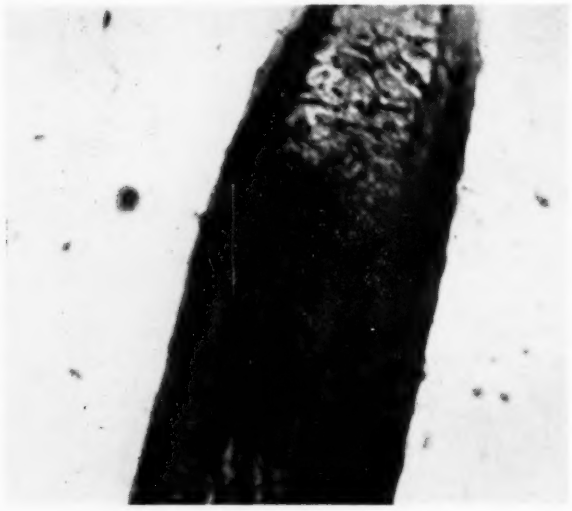

Figure 9

A Scotch Blackface wool fiber sectioned at one end to show the extensive medullation of the fiber which is not so apparent in the uncut fiber.

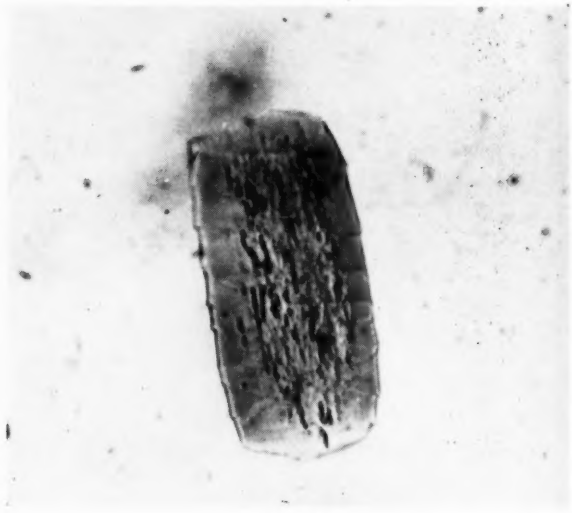

Figure 11

This is a small section of a non-medullated wool fiber with only the extreme outer part of the scale structure removed by longitudinal sectioning.

Figure 9 shows a photomicrograph of a partially sliced Blackface wool fiber dyed top chrome with 3% Calcochrome Blue Black Conc. The uncut area shows little if any evidence of the extensive medullated structure, which is revealed by sectioning. The East Indian wool fiber shown in Figure 10 was dyed with 1.5% Calcochrome Blue Black Conc and top chromed. The fiber is mounted so that the top section is raised to facilitate the examination of the interior. Medullation and voids are well defined.

Figure 11 shows a small section of a nonmedullated wool fiber from which only the extreme outer scale surface has been removed by sectioning. The fiber had been dyed with 2% of a half-chrome complex orange dye for wool, using 8% of ammonium sulfate and 8% anhydrous sodium sulfate on the weight of the fiber. An addition of 2% acetic acid 28% was made to complete the exhaustion. This dye is typical of those which concentrate in the intercellular spaces in the cortex. *(11)*. Note the longitudinal character of these deposits

Figure 12

Cross-section of a wool fiber dyed with a half-chrome complex orange dye which concentrates in the intermicellular voids in the cortex as shown by the several dark areas within this fiber.

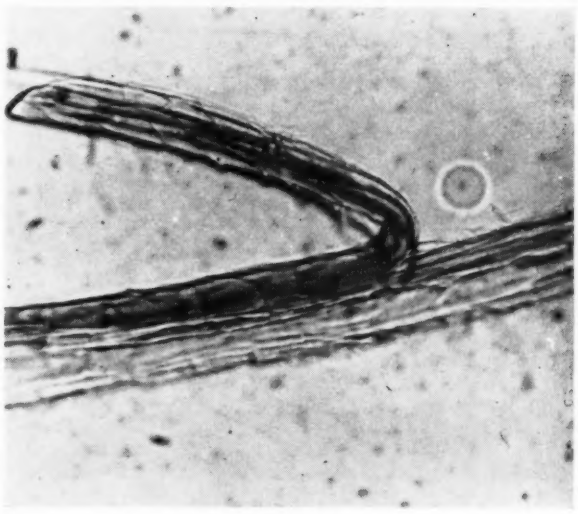

Figure 14

An East Indian wool fiber cut longitudinally on two sides to remove the cuticle and expose the corticle cells.

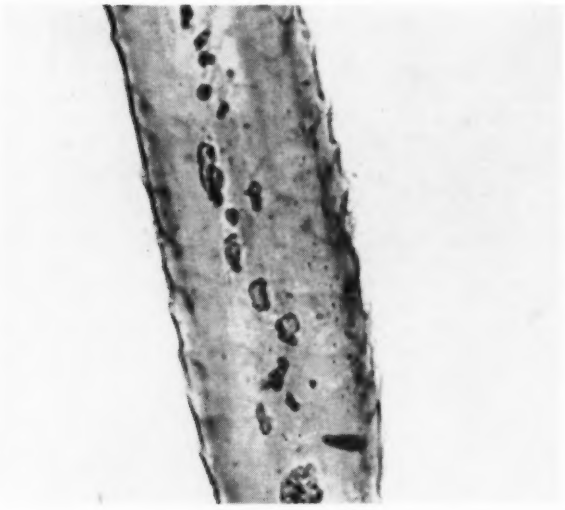

Figure 13

A longitudinal section of an East Indian wool fiber showing interrupted medullation.

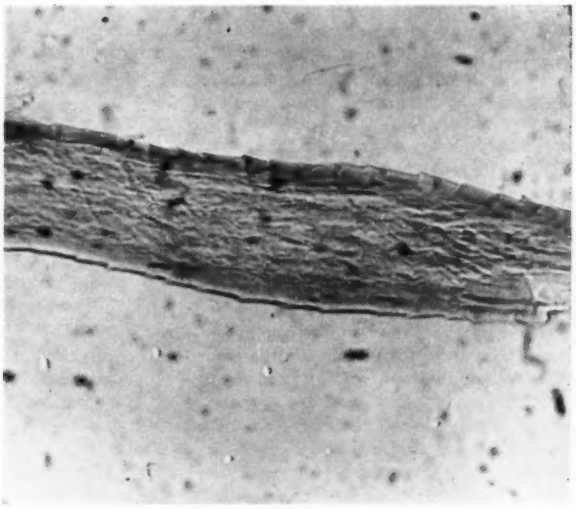

Figure 15

A wool fiber sectioned longitudinally to show the fibrillar structure.

and the fibrillar structure of the interior. Figure 11 should be compared with Figure 12, which shows a cross-section of a wool fiber dyed with this same orange dye. The greater detail revealed by longitudinal sectioning is apparent.

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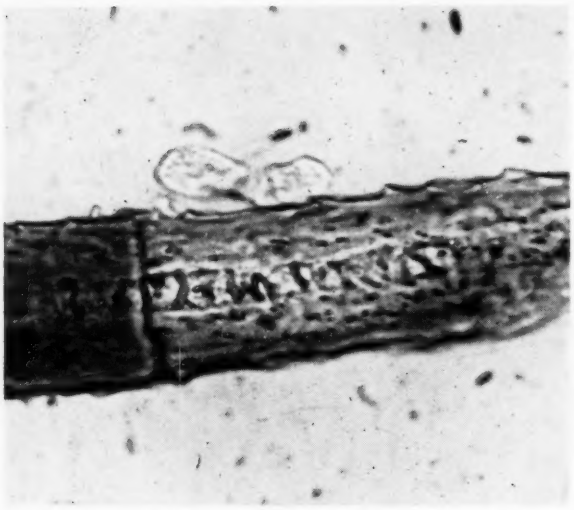

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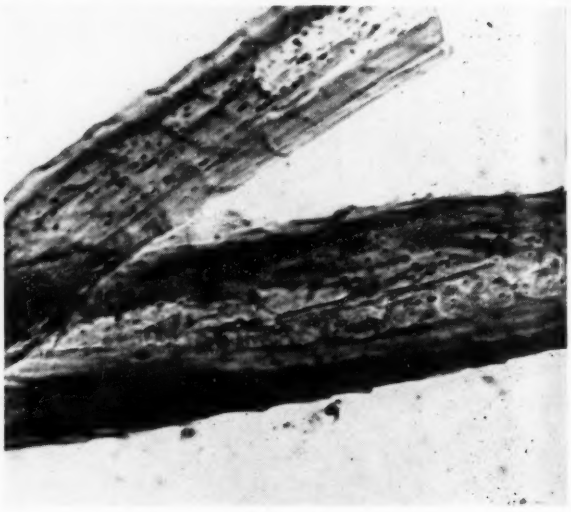

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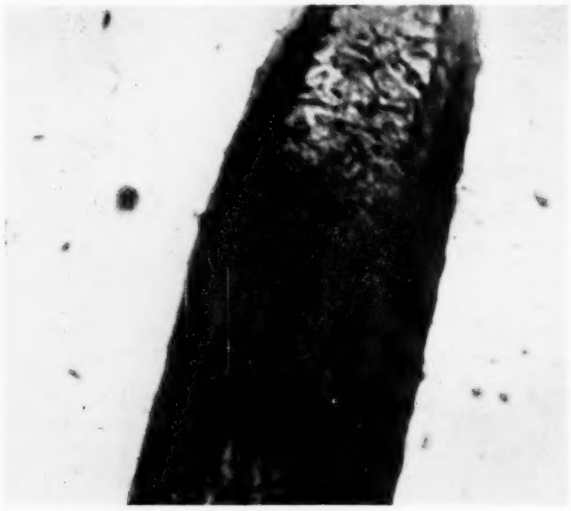

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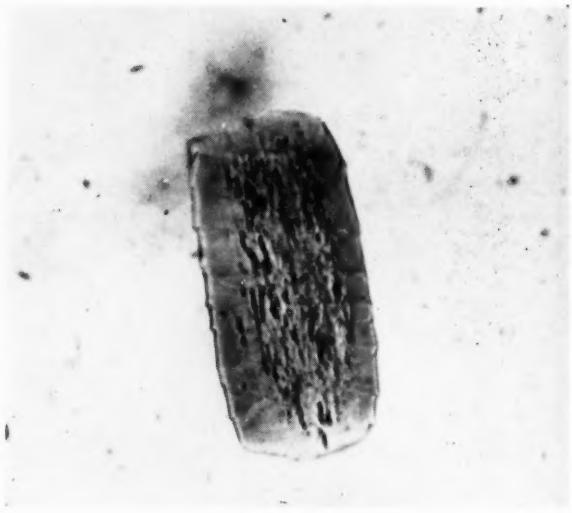

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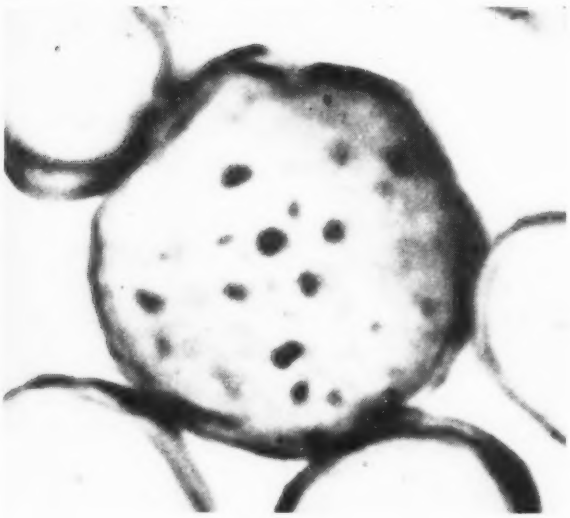
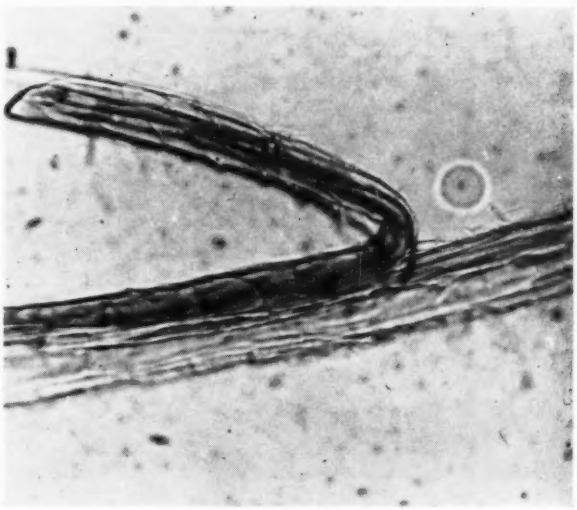


Figure 12

Cross-section of a wool fiber dyed with a half-chrome complex orange dye which concentrates in the intermicellular voids in the cortex as shown by the several dark areas within this fiber.



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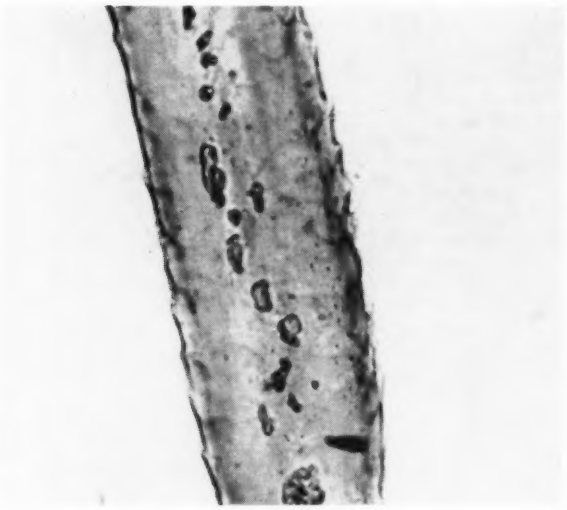

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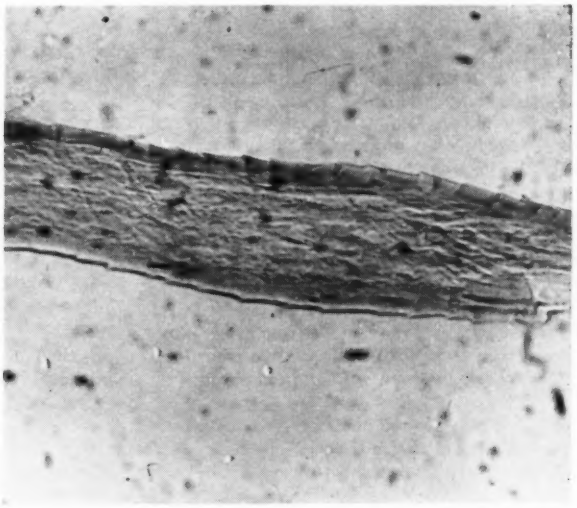

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(11) Royer, G L, and Maresh, C, "A Microscopical Study of Dyed Wool," *Am Dyestuff Reptr* **32**, 181 (1943).

Dyeing in the Burlington Beam Machine ———

(*Concluded from page P330*)

Q: In connection with the cuprous-ion process with the Burlington Beam Dyeing Machine, is some sort of a carrier used in that connection?

A: No, carriers are not needed.

Q: But the process can be conducted on the Burlington Machine?

A: Yes, some dyeing of Orlon acrylic fiber has been carried out on the Burlington machine.

Q: You mentioned comparatively low liquor ratios. What would they normally run?

A: About 10 to 15 to 1 liquor-to-fabric ratio.

Q: What is the level of the dyebath in the open system—meaning, within the tank?

A: When the dyeing is started with the pump running, enough water to cover the beam package is all that is required.

Q: How would you employ the cuprous-ion method as to application under pressure versus dyeing in an open dyebath?

A: That was covered quite thoroughly in the paper. The cuprous-ion process involves use of the acid colors on Orlon. Usually, the bath is set at around 180°F or slightly lower. Copper sulfate and sodium nitrate are added, and the temperature raised to 190°F. At that point sodium bisulfite and glyoxal are added and the temperature is raised immediately to 240°F.

Q: Does that have any adverse effect as to the speed there for level dyeing?

A: Some dyes exhibit rather rapid exhaustion, which can be controlled to a certain extent by the addition of sulfuric acid. The acid slows down the rate of absorption of cuprous-ion, which controls the dyeing process.

There are many other ways of controlling the dyeing, for example, by stepwise additions of the copper sulfate before pressurizing. But once the machine is pressurized, the reducing system should be pretty well established.

New Textile Products from Plastics ———

(*Concluded from page P326*)

yet have durable wearing surfaces through these lower-cost simplified constructions.

Where do we go from here? For 40 centuries industry has slowly moved along, developing beautiful fabrics to be sure, but until the advent of the nonwoven principle, no real new basic ideas had come out of centuries of study. The field of nonwoven fabrics appears unlimited. The range of properties obtainable is now greater than ever before. The ideal may finally be approached, which, in the clothing field, for example, would result in a garment weighing practically nothing, with ideal insulating properties, weather and wear resistant, and having an unlimited range of colorability and attractiveness.

If the textile industry does not take fuller advantage than it currently has in developing and processing this new concept into its many ramifications as rapidly as possible, certainly the plastics industry will "steal the ball." For example, the plastics industry has increased the sale of vinyl film and sheeting from practically nothing in 1945 to well over one billion yards in 1955. The consuming field knew practically no limit when the plastics industry started to promote vinyl film as a textile material. It was rapidly sold as a shower curtain, a raincoat, a kitchen curtain, as tablecloths, and, in the heavier gauges, as material covering for low-cost furniture. The industry made some mistakes but has since gained a solid maturity and a definite place in many fields where formerly woven textiles held absolute sway.

The plastics producers have not hesitated to spend on research and development relatively large proportions of their sales dollars to make these gains, and they have invested millions of dollars in new capital equipment to fabricate these products. There is no doubt they anticipate going a great deal further in this field. They have now learned to laminate materials and by using relatively thin nonwoven fabrics in conjunction with unsupported vinyl sheeting, versatility in application has been greatly increased

The plastics industry's growth potential, with output said to almost double every five years, has certainly been paced adequately by the development of new ideas and merchandising "know-how." The field of reinforced plastics has one of the fastest growth rates in the group. Nonwoven fabrics, as such, are literally only a flexible form of reinforced plastics, a field wide open to the plastics fabricator since the processes and materials used in producing nonwoven fabrics are identical in many ways to those already employed in the plastics industry.

Only 30 companies in the textile field have spent appreciable effort in the development of nonwoven fabrics. Of these, some 6 or 7 among the largest are well in the lead with capital investments in the millions of dollars. However, the textile mill products and apparel industry spent only $28 million in 1953 on research and development as compared with $361 million expended by the chemical industry. In the face of this 13-fold difference, manufacturers' sales of the former amounted to $13.2 billion in 1953 as againt $19.3 billion for the latter. Research and development expenditures per production worker amounted to $13 in textiles in 1953 as compared with $654 in the chemical industry. Research costs as a ratio of sales were nine times greater in the chemical than in the textile industry. With plastics products such a substantial segment of the chemical industry, it would appear that even this dynamic segment has outstripped textiles in research and development. To catch up, the textile industry will have to be willing to hire more technical people and designers, as well as invest extensively in new capital equipment. The challenge is there. It is an excellent opportunity for the textile world to overcome its many and varied problems of the past, to improve its income, and to contribute to the industrial growth and development of American industry.

Perkin Centennial Notes

TENTATIVE GENERAL PROGRAM

THE WALDORF-ASTORIA
NEW YORK, N Y
September 10-15, 1956

MONDAY, SEPTEMBER 10, 1956

International Day

Sponsor: **American Standards Association and the International Organization for Standardization**

Morning

Topic: **Colorfastness of Textiles**

Sponsors: **American Association of Textile Chemists and Colorists and the American Society for Testing Materials**

Paper: A Century of Progress in Colorfastness Test Methods

Speaker: M L Staples, Ontario Research Foundation

Paper: Current Developments in Colorfastness Testing: France

Speaker: J P Niederhauser

Paper: Current Developments in Colorfastness Testing: Germany

Speaker: To be announced

Paper: Current Developments in Colorfastness Testing: Switzerland

Speaker: To be announced

Paper: Current Developments in Colorfastness Testing: United Kingdom

Speaker: P W Cunliffe, British Cotton and Wool Dyers Association

Paper: Current Developments in Colorfastness Testing: USA

Speaker: Charles A Sylvester, E I du Pont de Nemours & Co, Inc

Luncheon

Topic: **Sir William Perkin—His Life and Works**

Speaker: Sir Robert Robinson, The Society of Dyers and Colourists

Afternoon

Topic: **Color—The Catalyst of Commerce**

Sponsors: **American Standards Association and the International Organization for Standardization**

Speakers: A distinguished panel of leaders in their fields, including three European experts, will discuss and answer questions on the impact of man-made color on advertising, automobiles, consumer products, converting, dyestuffs and fine chemicals, fabric manufacturing, fiber manufacturing, finishing, garment manufacturing, household appliances, packaging, paper, plastics, retailing, safety, style and fashion, and television.

TUESDAY, SEPTEMBER 11, 1956

Topic: **The Application of Colorants to Plastics**

Sponsor: **The Society of the Plastics Industry, Inc**

Paper: The Application of Colorants to Polystyrene and Modified Polystyrene Plastics

Speaker: George Godfrey, Koppers Co, Inc

Paper: The Application of Colorants to Rubber and other Elastomeric Plastics

Speaker: H M Whitacre, Akron Chemical Co

Paper: Ultraviolet Absorbers in Plastics

Speakers: W B Hardy and Ralph Coleman, American Cyanamid Co

Paper: Colorants for Acrylic Plastics

Speaker: S C Kelton, Jr, Rohm & Haas Co

Paper: The Preparation & Use of Special Polystyrene Color Standards for Fresh and Processed Food Products

Speaker: G W Ingle, Monsanto Chemical Co

* * *

Topic: **The Application of Colorants to Drugs**

Sponsor: **The American Pharmaceutical Association**

Paper: The Use of Colorants as Drugs and in Drugs

Speaker: Jack Cooper, Ciba Pharmaceutical Products, Inc

Topic: **The Application of Colorants to Leather**

Sponsor: **The American Leather Chemists Association**

Paper: The Chemical and Physical Nature of Leather Fibers in Relation to Dyeing

Speaker: Robert Stubbings, Chemistry Dept, Lehigh Univ

Paper: Coloring of Leather on Which Penetration is Desired

Speaker: Joseph A Casnocha, Sandoz Chemical Works, Inc

Paper: The Spray or Brush Dyeing of Leather

Speaker: C H Geister, E I du Pont de Nemours & Co, Inc

Paper: Dyes and Dyeing Processes for Special Properties of Color

Speaker: J S Kirk, General Aniline & Film Corp

* * *

Topic: **The Application of Colorants to Cosmetics**

Sponsor: **Society of Cosmetic Chemists**

Paper: Color in Cosmetics

Speaker: Donald H Powers, Warner-Lambert

* * *

Topic: **The Application of Colorants to Paper**

Sponsor: **Technical Association of the Pulp and Paper Industry**

Paper: To be announced

Speaker: Leonard Schlosser, Schlosser Paper Corp

* * *

Topic: **The Physics of Color**

Sponsors: **Optical Society of America, Inter-Society Color Council, and American Society for Testing Materials**

Paper: Color Control—Twenty-Five Years Progress

Speaker: Frank J O'Neil, Pacific Mills

Paper: Progress in Measuring Color Differences

Speaker: G W Ingle, Monsanto Chemical Co

* * *

Topic: **Color in National Defense**

Sponsor: **National Research Council Advisory Committee**

Paper: Color in National Defense

Speaker: Stephen J Kennedy, Headquarters, Quartermaster Research and Development Command

* * *

Topic: **The Impact of Synthetic Dyes on Our Economy**

Sponsor: **US Department of Commerce**

Paper: The Impact of Synthetic Dyes on Our Economy

Speaker: Charles C Concannon, US Dept of Commerce

WEDNESDAY, SEPTEMBER 12, 1956

Topic: **The Application of Colorants to Food**

Sponsor: **Institute of Food Technologists**

Presiding: B E Proctor, Department of Food Technology, MIT

Paper: The Structure & Properties of Present-Day Food Colors

Speaker: Samuel Zuckerman, H Kohnstamm & Co, Inc

Paper: Sugar and Chocolate Candies

Speaker: Philip Gott, National Confectioners' Assn

Paper: Meat and Meat Products

Speaker: Henry Kraybill, American Meat Institute Foundation

Paper: Cereals and Baked Products

Speaker: William B Bradley, Scientific Div, American Institute of Baking

Paper: Significance of Color in Dairy Products

Speaker: Arnold A Johnson, National Dairy Research Laboratories, Inc

Paper: Citrus Products

Speaker: Kenneth H Klipstein, American Cyanamid Co

Paper: Psychological Aspects of Food Colors from the Consumer's Standpoint

Speaker: Dean Foster, US Testing Co, Inc

* * *

Topic: **Pigments and Color Lakes**

Sponsors: **Dry Color Manufacturers' Association and the National Paint, Varnish and Lacquer Association, Inc**

Paper: Advances in Phthalocyanine Technology

Speaker: R E Brouillard, General Aniline & Film Corp

Paper: The Influence of Perkin's Discovery on the Graphic Arts Industry

Speaker: Thomas Craig, Sun Chemical Corp

Paper: The Influence on Mankind of Colorants in Organic Coatings

Speaker: Frank Connolly, John W Masury & Son

Paper: The Chemistry of Organic Pigments

Speakers: A Siegel and W S Struve, E I du Pont de Nemours & Co, Inc

Paper: The Economic Significance of Colorants in Coatings

Speaker: Norman S Cassel, Interchemical Corp

* * *

Topic: **The Psychology of Color**

Sponsors: **American Psychological Assn & the Inter-Society Color Council**

Paper: Description of Color

Speaker: Deane B Judd, National Bureau of Standards

Paper: Seeing Light and Color

Speaker: Ralph M Evans, Eastman Kodak Co

Paper: Color in Industrial Design

Speaker: Walter C Granville, Container Corporation of America

* * *

Topic: **Color Harmony from Fashion to Industry**

Sponsor: **The Color Association of the United States, Inc**

Paper: Color Harmony from Fashion to Industry

Speaker: John F Warner, D B Fuller & Co

* * *

Topic: **The History of Color**

Sponsor: **American Association for the Advancement of Science**

Paper: Color in Relation to the Political and Economic History of the Western World

Speaker: S M Edelstein, Dexter Chemical Co

Paper: Color in Ancient Times

Speaker: Earle R Caley, Ohio State University

THURSDAY, SEPTEMBER 13, 1956

Morning

Topic: **The History of Dyeing**

Sponsor: **American Association of Textile Chemists and Colorists**

Paper: The Development of Fast Colors for Textiles

Speaker: F M Fordemwalt, American Cyanamid Co

Paper: The Development of the Art of Textile Printing

Speaker: Herman P Baumann, American Aniline Products, Inc

Paper: The Development of Modern Textile Dyeing Techniques

Speaker: Paul Meunier, E I du Pont de Nemours & Co, Inc

* * *

Topic: **The Manufacture of Synthetic Dyes**

Sponsors: **Synthetic Organic Chemical Manufacturers Association and the Manufacturing Chemists' Association, Inc**

Paper: The Manufacture of Synthetic Dyes

Speaker: Samuel Lenher, E I du Pont de Nemours & Co, Inc

Noon

Olney Medal Award Luncheon

Afternoon

Topic: **The Application of Colorants to Textiles**

Sponsors: **American Association of Textile Chemists and Colorists and the Canadian Association of Textile Colourists and Chemists**

Paper: The Application of Colorants to Glass Fibers

Speaker: R F Caroselli, Owens-Corning Fiberglas Corp

Paper: Internal Application of Color in the Manufacture of Man-Made Fibers

Speaker: C E Coke, Courtaulds, Ltd

Paper: Improvements in Dyeing Cotton with Sulfur Colors

Speakers: John Crist and Raphael Rupp, Southern Dyestuff Corp

Afternoon

Topic: **Color in the World of Fashion**

Sponsors: **Good Housekeeping Institute and the National Retail Dry Goods Association**

A Stage Presentation—Cavalcade of Color—depicting Color in the World of Fashion

FRIDAY, SEPTEMBER 14, 1956

Topic: **The Chemistry of Synthetic Dyes**
Sponsor: **American Chemical Society**

Morning

Topic: **Symposium—A Century of Progress in the Synthesis of Dyes**

Presiding: M L Crossley

Paper: Early Synthetic Dyes

Speaker: Hans Z Lecher, consultant

Paper: Dyes for Cotton

Speakers: W W Williams and D L Randall, General Aniline & Film Corp

Paper: Dyes for Animal Fibers

Speaker: James Ogilvie, National Aniline Div, Allied Chemical & Dye Corp

Paper: Dyes for Nontextile Coloration

Speaker: M A Perkins, E I du Pont de Nemours & Co, Inc

Afternoon

Paper: Dyes for the Hydrophobic Fibers

Speakers: H F Schroeder & S N Boyd, Jr, E I du Pont de Nemours & Co, Inc

Paper: Dyes in Photography

Speaker: L G S Brooker, Eastman Kodak Co

Paper: Fluorescent White Dyes

Speaker: Mario Scalera, American Cyanamid Co

Evening

Perkin Medal Award Banquet

Sponsor: **The American Section of the Society of Chemical Industry in conjunction with**
American Chemical Society
American Institute of Chemical Engineers
Electrochemical Society
American Section of the Societe de Chimie Industrielle

SATURDAY, SEPTEMBER 15, 1956

Topic: **Theories of Dyeing**

Sponsor: **Textile Research Institute**

Presiding: Howard J White, Jr, Textile Research Institute

Paper: The Theory of Dyeing Natural and Synthetic Polyamide Fibers

Speaker: Milton Harris, Harris Research Laboratories

Paper: The Theory of Dyeing Cellulosic Fibers

Speaker: Emery I Valko, Onyx Oil and Chemical Co

Paper: The Theory of Dyeing Polyacrylic and Polyester Fibers

Speakers: W R Remington & H F Schroeder, E I du Pont de Nemours & Co, Inc

AATCC Intersectional Contest

Sponsor: **American Association of Textile Chemists and Colorists**

Participating Sections:

Hudson-Mohawk	Philadelphia
Midwest	Piedmont
New York	Rhode Island
Northern New England	South Central
Pacific Southwest	South Eastern

Washington

Evening

Annual AATCC Banquet

Membership Applications

April 6, 1956

JUNIOR

Tomas Furth—Trainee, United Merchants & Manufacturers, Inc, New York, N Y. Sponsors: C Z Draves, H Halvorsen.

Frederick W Neubrech—Lab tech, Harris Research Labs, Washington, D C. Sponsors: L R Mizell, A M Sookne.

ASSOCIATE

Robert Elmendorf—Mill mgr, Lobsitz Mills Co, Nutley, N J.

Heriberto M Martinez—Text engr foreman, Nat Aniline Div, Allied Chem & Dye Corp, Hopewell, Va.

Savino F Rinaldi—Vice pres, Louis Hornick & Co, Inc, Haverstraw, N Y.

CORPORATE

Frankford Woolen Mills, Inc
A & M Karagheusian, Inc
Virginia Mills, Inc

APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP

William T Brown
Frank J Murphy

April 20, 1956

SENIOR

William E Baldwin—Assistant plant chemist, Fairforest Fin Plant, Spartanburg, S C. Sponsors: W E Rixon, L C Greene.

Graham Barker—Tech Repr, Emulson Chemical Corp, Chicago, Ill. Sponsors: C R Trommer, F H Buck, Jr.

Inge Berge—Tech demonstrator, Dr Ing, Otto Falkenberg, A/S, Bergen, Norway. Sponsors: C A Sylvester, H F Fischer.

David H Cool—Dyer, The Johnstown Knitting Mill Co, Inc, Johnstown, N Y. Sponsors: A P Shutts, W A Nelson.

Alfred Greenfield—Dir of fabric development & merchandising, Virginia Carolina Chemical Co, New York, N Y. Sponsors: L Billings, J H Karrh.

James J Handy—Assistant mgr, Plant #1, Crompton Shenadoah Co, Waynesboro, Va. Sponsors: D W Snyder, H Kinder.

Edward G Mullen—Sales, F H Ross & Co, Charlotte, N C. Sponsors: P S Gilchrist, W A Wolhar.

James R Myles—Tech assistant, Imperial Chem Industries, New York, N Y. Sponsors: W C Cobb, A C Merrill.

Melvin R Richardson—Lab tech (dyeing), Excelsior Mills, Union, S C. Sponsors: K S LaFleur, J L Johnson.

F Kelly Ross—Salesman, Diamond Alkali Co, Cleveland, O. Sponsors: H R Ketchie, A G McNair.

Eugene S Swain—Dyer, Delta Fin Co, Div J P Stevens Co, Wallace, S C. Sponsors: B F Rivers, C H Payet.

ASSOCIATE

Eric Peter Hersey—Vice pres, Warnock Hersey Co, Ltd, Montreal, Canada.

Richard B Loomis — Salesman, United Chemical Co, Portland, Ore.

Addison B Shaw—Salesman, Diamond Alkali Co, Cleveland, O.

Roger R Zoccolillo — Chemical salesman, Dow Chemical Co, Camden, N J.

CORPORATE

Boris Kroll Fabrics, Inc

STUDENT

Charles W Funderburk — Clemson College. Sponsor: J Lindsay, Jr.

Activities of the Local Sections

Mid-West

The Spring Meeting of the Mid-West Section was held at the Plankington House, Milwaukee, Wis, on May 5th with approximately 60 members and guests in attendance.

Arthur I Hultberg, chairman, called the afternoon session to order at 3 pm. Following reports by the secretary and treasurer, Joseph H Jones, AATCC vice president, reported on national activities.

A report on plans for the 1958 convention was given by Chairman Elliott Morrill, who announced the formation of the following committees and respective chairmen: *Technical Program*—Arthur J Andrews; *Entertainment*—J Gordon Stott; *Ladies*—Archie G Alexander; *Hotel Reservations*—E J Sindt; *Registration*—F S Stover; *Dining*—Warren B Broadbent; *Reception*—David Anderson; *Printing*—John L Eich; *Finance*—(Section treasurer at the time); *Publicity*—Jack G Kelley; and *Transportation*—H Thompson Latham. Edwin I Stearns will serve as vice chairman.

L B MacFarland reported on activities of the National Convention Committee; E J Sindt discussed plans for the June outing at Brown's Lake Resort; and Lee Johnston discussed the Section's 1956 Intersectional Contest paper plans.

It was announced that Victor Braun, Jr, is the recipient for the coming year of the Section's second annual Scholarship Award.

The guest speaker at the evening session was Lawrence S Thompson, manager, Technical Department, General Dyestuff Co, who spoke on "Current Developments in the Application of Dyestuffs."

Rhode Island

THE Rhode Island Section held its annual Student Night Meeting at the Rhode Island School of Design, Providence, RI, on Thursday, April 26th, with approximately 230 students, instructors, members and guests in attendance.

John R Frazier, president of RISD, opened the meeting with words of greeting to those in attendance. Honored guests included AATCC President Raymond W Jacoby; Ernest R Kaswell, AATCC vice president, New England Region; and Dr Gustave Schwen, Badische Anilin- & Soda Fabrik, Ludwigshafen am Rhein, Germany.

Featured speakers of the meeting were Kenneth R Fox, vice president, Fabric Research Laboratories, Inc, who spoke on "Textiles—Opportunities Unlimited"; and Nathaniel M Mitchell, president, Barnes Textile Associates, Inc, who spoke on "A Study in Modern Plant Design and Machinery Layout."

Tours were conducted through the Textile Building prior to the meeting.

The Section will hold its annual Ladies Night dinner-dance this Friday, May 25th, at the Sheraton-Biltmore Hotel in Providence.

Western New England

The ninth Annual Outing of the Western New England Section will be held June 15th at the Wallingford Country Club, Wallingford, Conn.

Pacific Northwest

A tour through Pendleton Woolen Mills' Washougal Mill, Washougal, Wash, and a talk by James Aitchison, superintendent, on the development of the woolen industry in the Northwest, highlighted the April 20th meeting of the Pacific Northwest Section. Mr Aitchison also discussed the background of the Washougal Mill.

The afternoon tour preceded cocktails and dinner in the Men's Grill of the Aero Club, Portland, Oregon, with twenty-seven members in attendance.

It was decided at the meeting to drop plans for the preparation of an Intersectional Contest paper by the Section for 1956.

Earl Fuller, Jantzen Inc, suggested that the Section approach the administration of the Portland schools with the idea of donating to Benson Polytechnic School any old equipment that the local mills might have to offer, along with the services of members of technical staffs to lecture on various phases of the textile industry. The objective would be to interest young men of the area in the textile industry.

F H Ihlenburg was appointed chairman of the Outing Committee, which is charged with formulating plans for an outing on July 28th at the Mt Hood Golf and Country Club. John L Ayres and Dale Kimsey will assist Mr Ihlenburg.

MID-WEST SECTION MEETING • FEBRUARY 11, 1956 • BISMARCK HOTEL, CHICAGO, ILL

HEAD TABLE (l to r): S M Littlejohn, vice chairman; K M Harms, treasurer; A I Hultberg, Chairman; W B Broadbent, secretary; J M Salsbury, guest speaker

Activities of the Local Sections

Philadelphia

A record attendance was set at the Philadelphia Section's Ladies Night Program on April 20th in the Crystal Ballroom of the Benjamin Franklin Hotel, as 480 members and guests enjoyed a complete fashion show of ladies', men's and children's wear. The theme "The Yarn Behind Fabrics of Fashion" set the pace for the show, which was presented by Aberfoyle of Philadelphia.

Thomas H Hart, Hart Products Corp, chairman of the Philadelphia Section, gave special note to the presence of Joseph P Holt, president of Aberfoyle; J S Kendrick and William Galey, Aberfoyle vice presidents; and Florence Lippincott, advertising manager and coordinator of the show.

Also in attendance were many of the national officers and councilors of AATCC, the 201st meeting of the Council having been held at the Hotel earlier in the day, staff members of the Philadelphia Textile Institute and Fashion Institute of Technology, and representatives of *Life*, *Look*, *American Fabrics*, *American Dyestuff Reporter*, Philadelphia *Inquirer*, Philadelphia *Evening Bulletin* and Fairchild Publications.

Thomas H Hart (right), Philadelphia Section chairman, presents a check for $500 to Bertrand W Hayward, president of Philadelphia Textile Institute at the Section's April 20th meeting

At the close of the Fashion Show, Martha Jungerman of the Philadelphia Textile Institute conducted a drawing of ladies' gifts. Mrs. Howard Graff won her choice of a suit or coat contributed by Zelinka-Matlick, a value in excess of one hundred dollars. Other gifts were contributed by Aberfoyle, George Wood Co, Inc, Roxborough Co, Inc, Hart Products Corp, Double Woven Corp, Talbott Knitting Mills, and the Philadelphia Section.

Mr Hart presented a check in the amount of $500 to Bertrand W Hayward, president of PTI, representing the funds remaining from the recent course given by the Section.

A full page of fashion, featuring twenty photos of the show presented by Aberfoyle of Philadelphia before the Ladies Night Meeting of the Philadelphia Section on April 20th, will appear in the next issue of American Dyestuff Reporter. Watch for it in the "Activities of the Local Sections."

Activities of the Local Sections

LADIES NIGHT
PHILADELPHIA SECTION
AMERICAN ASS'N OF TEXTILE CHEMISTS & COLORISTS
BENJAMIN FRANKLIN HOTEL — APRIL 20, 1956

Piedmont

A full slate of activities is scheduled once again for the Piedmont Section's two-day outing next month at Mayview Manor, Blowing Rock, NC.

Friday afternoon, June 8th, will feature golf, cards, horseshoes, ping-pong, shuffleboard, putting, horseback riding, fishing, swimming, and visits to the Cone Estate. A supper and square dance are scheduled for Friday evening.

Saturday morning, June 9th, will feature men's and women's golf tournaments, a special ladies' program, and other activities enumerated above. A ladies' luncheon and bridge and canasta parties are scheduled for the afternoon.

The usual social hour, buffet and dance will conclude the day's activities.

Activities of the Local Sections

New York

A meeting of the New York Section was held on Friday evening, April 27th, 1956 at Kohler's Swiss Chalet, Rochelle Park, New Jersey. The Chairman, John H Hennessey, appointed the following nominating committee: Paul J Luck, Chairman, P J Wood and Norman A Johnson. W L Thomson, Manager of the Radiant Heater Division of the Edwin L Wiegand Company presented a paper entitled "Application of Metal Sheath Electric Heaters." The attendance was approximately 150.

Niagara Frontier

Approximately 30 members attended the meeting of the Niagara Frontier Section held April 27, 1956, in the Science Building, Canisius College, Buffalo, N Y.

Fred V Traut, AATC regional vice-president, spoke briefly on various activities of the national organization, including national convention sites.

Bernard K Easton, reporting on the April 20th Council Meeting, stated that, although the Niagara Frontier Section had not been successful in its bid for the 1960 Convention, he felt that Buffalo would receive favorable consideration if a bid were made for the year 1961.

E I Birnbaum, Hart Products of Canada Ltd, spoke on "Sequestering Agents," tracing the chemical structure of those products in common usage.

MEETING OF THE RHODE ISLAND SECTION

March 22, 1956

Crown Hotel & Quarters of Providence Engineering Society, Providence, RI

(Photos courtesy of John E Trezise)

TESTIMONY PRESENTED BEFORE HR SUBCOMMITTEE ON RIVERS AND HARBORS, COMMITTEE ON PUBLIC WORKS

by E A LEONARD*

As a representative of the textile wet-processing industry, Mr Leonard was invited to make a statement in the public hearings on a new bill which will replace the present federal law on stream sanitation, due to expire next month.

The text of Mr Leonard's testimony, made in Washington on March 15, 1956, is presented.

IN my employment capacity, I represent the largest company in one branch of the textile industry with plant locations as follows: 2 plants in Massachusetts, 1 plant in New York State, 2 plants in Pennsylvania, 2 plants in South Carolina, 1 plant in Delaware, and 1 plant in Mississippi. I have been aware of the water resources problem and assigned responsibility in stream sanitation for my company since 1948. As a member of the National Technical Task Committee on Industrial Wastes, I have represented the textile wet processing industry since 1951, and have extended this membership throughout the industry via the American Association of Textile Chemists and Colorists, which is the national technical association of the textile wet processing industry, comprising of 8,000 members and 300 company members, including all of the biggest textile mills in the nation. Stream Sanitation committees have been set up within the local geographical sections of AATCC, with the chairmen of these local sections composing a National Stream Sanitation Committee. These committees have existed since 1952, and have accomplished the following activities:

A) Publication of a complete glossary of terms related to stream sanitation.

B) Published a complete list of references on textile wastes, their properties, prevention, abatement, treatment, and test procedures.

C) Published a series of case histories illustrating successful solutions by textile mills of stream pollution abatement problems.

D) Conducted research projects on specific textile waste problems.

E) Determined the polluting effects of all major textile wastes and processing chemicals and dyes and have studied to some extent how pollution abatement can be assisted by the judicious choice of processing chemicals and by plant management procedures for minimizing waste at the source.

F) Supplied on request, to corporate members of the association, information on their specific problems, to the extent of advising sources of information and references.

G) Conducted technical sessions and symposia at two annual national conventions at Boston and Atlanta, which were attended and addressed, by invitation, by federal, state, and local authorities.

The results of these activities are that the textile industry has been made aware of the water resources and stream sanitation problems; that technical information has been made available to the industry on the polluting effects of its process wastes, how to eliminate the wastes and the best available data on treatments and cost of treatments.

This background is presented to indicate how much it has been possible to accomplish within the framework and cooperative atmosphere of PL 845, which encouraged research and technological study.

Now as for future needs: The good work promulgated under PL 845 is just begun. Industrial wastes are much more individual in their characteristics than domestic wastes. Wastes of the metallurgical industry are totally different from those of the petroleum, and those of the textile industry are almost totally different from both, although there is a relationship between certain textile wastes and those of the paper, leather, and chemical industries. Several textile processing wastes cannot yet be satisfactorily treated within the scope of practical economics, and there continues a need for technological investigations. Problems are most economically solved on a cooperative basis in this relatively noncompetitive field of stream sanitation, where the cost of research would be multiplied to no useful purpose for replicate individual researches on the same subject. We should therefore continue our contacts with other industries having related wastes and continue the cooperative researches which have been started.

With respect to continuing legislation, I wish to make the point that time is required to establish working relationships. The contacts that we, in my industry, have made with other industries through the auspices of the National Technical Task Committee on Industrial Wastes and through the Department of Health, Education and Welfare, are just reaching effectiveness. In view of the problems yet before us, therefore, it is necessary that these working relationships be continued. The researches on industrial wastes which have been encouraged under PL 845 should be continued and enlarged in scope to get results faster.

HR 9540 provides for a continuance of the good work started under PL 845—a continuance of working relationships and enlargement of research efforts. I am therefore in favor of this bill and recommend its passage.

The above material refers mainly to Section 1 through 4 and Section 7 of HR 9540. I wish to make a statement about Section 6 which provides federal grants for assistance in the construction of municipal and other local waste treating facilities. It is clear from the wording of Section 6 that the financing problems of states, municipalities, etc, are recognized, but the financial problems of industry are not mentioned. By and large, construction grants to municipalities will improve pollution by domestic sewage only, except to the extent that industrial wastes are combined with domestic in the treatment of sewage. Industrial organizations have financial problems also—textile mills are not high profit makers: In the last 5 years of broken production and profit records by industry in general, many textile mills have lost money.

In four of the nine cities where plants of my company are located, the plant is the major local tax payer. The community would probably be eligible for construction grants under HR 9540, while the company is not eligible for assistance of any kind. I recognize that rapid amortization provisions for waste treating facilities to provide industrial tax relief have been tried but have always failed, perhaps because they are tacked on to revenue bills rather than built into the stream pollution abatement legislature itself.

I do not have a solution to this problem; I merely present it to the Subcommittee for consideration. Statistics have indicated that industrial waste represents an appreciable percentage of the loss of water resources in this country. This being the case, I believe that industry financing problems for waste treating facilities should be considered in some way as well as municipal financing problems.

With respect to the sections on enforcement, I feel that HR 9540 provides sufficient latitude so that any company involved in a pollution problem will have adequate time to work out suitable action.

*Formerly director, research & engineering, Alexander Smith Div, Mohasco Industries, Inc, Yonkers, NY.

Engineering Aspects—

(*Concluded from page 324*)

is needed in order to blend textile craftsmanship with modern textile science if the textile industry is to exploit its opportunities and meet its obligations in the world of today and tomorrow."

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(10) Hamburger, W J, and Platt, M M, "An Engineering Approach to the Analysis and Design of Textile Structures," *J Textile Inst* **44**, No. 8, August, 1953.
(11) Hamburger, W J, "The Application of Sonic Techniques to the Investigation of the Effects of Visco-Elastic Behavior upon Stress-Strain Relationships in Certain High Polymers," *Textile Research J* **18**, No. 12, Dec 1948.
(12) Hamburger, W J, "The Industrial Application of the Stress-Strain Relationship," *J Textile Inst* **40**, No. 7, July, 1949.
(13) Smith, H DeW, "Textile Fibers: An Engineering Approach to Their Properties and Utilization," (Nineteenth Edgar Marburg Lecture) *ASTM Proc* **44**, 543, 1944.

Abstracts

A New Approach to Dyeing

Peters, L and Stevens, C B, *Dyer* **115**, 327-9, March 2, 1956.

The authors state that no one can be completely satisfied with many conventional dyeing methods, e.g., those for applying dyes to wool. Adding acids in order to get a deep enough color, raising the dye solution to the boil and maintaining it at that temperature for perhaps hours to get a level effect can hardly be regarded as a simple process for coloring a textile material. The wool, too, must suffer some damage from such prolonged boiling, and the cost of steam and time is considerable.

It is futile to search for dyes that will 1) be readily soluble in water, 2) dye and level rapidly, and 3) give dyeings fast to washing, because these requirements are mutually contradictory.

Dyeing in a solvent other than water has been suggested, but in the past the cost of solvents has been prohibitive. The authors have now found that it is not necessary for the dyebath to be entirely composed of solvent. There are also special solvents which improve the dyeing characteristics of certain dyes, and confer dyeing properties on certain compounds, eg, pigments, not normally considered to be dyes. Solvents which are only slightly soluble in water, but which have an affinity for the fiber, may be applied directly, or from solution or from an emulsion, either in the dyebath itself or as a pretreatment. When absorbed, the solvent in the fiber forms a separate phase from the rest of the dyebath—a sort of minute solvent dyebath within the fiber. If the particular dye or pigment is soluble in such a solvent, the rate of diffusion of the color into the absorbed solvent will be rapid, and the rate of diffusion of the dye from it into the fiber may be so high that the total rate of dyeing can be markedly accelerated.

For example, the rate of absorption of certain acid and premetallized dyes on wool is greatly accelerated by the addition to the dyebath of only 7 percent (by volume) of n-butanol, and the dyeing temperature need not exceed 60° C. Certain pigment dyes have also been successfully applied by this technique.

The authors explain that much work remains to be done to find the most effective solvent, and perhaps to manufacture dyes that are more suitable for this method. There are also the problem of toxicity of the solment, the danger of dermatitis, etc, to be considered.—WHC

Dermatitis from Nylon Stocking Dyes

Calnan, C D and Wilson, H T H, *Dyer* **115**, 273, February 17, 1956.

In an article in the *British Medical Journal* the authors, both doctors, describe six cases of dermatitis caused by the dyes in nylon stockings. In one of these cases a woman complained of eczema on the forehead and rashes on the legs and feet. The trouble was traced to a nylon hairnet and nylon stockings.

The authors state that the great majority of patients with nylon stocking dermatitis are allergically sensitive to the dye. Two types of dye are used for nylon—those from azo and those from anthraquinone derivatives—but dyers of nylon stockings in England use the azo variety, which has proved more satisfactory in practice from the dyeing standpoint. Shades required are usually obtained from mixtures of red, blue and yellow dyes.

The authors state that they have been unable to find a brand of nylon stockings incorporating anthraquinone dyes. However, one manufacturer agreed to make such stockings at their request. Patch tests to these dyes were negative in the patients who were allergic to the azo dyes.

The authors suggest the possibility of having a limited number of anthraquinone-dyed stockings made for the few persons who are affected by azo dyes. They agree that the price would probably be prohibitive.

Incidentally, they state that dermatitis is sometimes caused also by synthetic resins used as coatings on nylon hosiery to give an anti-snag finish.—WHC

Molybdenum Organic Pigments

Williams, W W and Conley, J W, *Ind Eng Chem* **47**, 1507-10, August, 1955.

The principal use of molybdenum in organic pigments is in the form of the complex heteropoly acids, phosphomolybdic and phosphotungstomolybdic acids. These compounds, along with phosphotungstic acid, constitute precipitating agents for numerous basic and other closely related dyestuffs, resulting in a class of organic pigments noted for brilliance, strength, and greatly improved stability to light, heat, and water compared with the earlier pigments of this type. Dyestuffs when precipitated with phosphomolybdic acid are known as PMA colors, with phosphotungstic acid as PTA colors, and with a mixture of these acids (phosphotungstomolybdic acid) as PTMA colors.

Typical dyes which are employed in the manufacture of PMA and PTMA colors include Malachite Green, Brilliant Green, Setoglaucine, Methyl Violet B, Ethyl Violet, Victoria Pure Blue BO, Rhodamine B and 6G, and Thioflavine.

The composition and structure of the PMA colors and the general method of their preparation are described by the authors.

In addition to brilliance and strength, which properties are desired in all organic pigments, the most important characteristics of this class of colors are resistance to light, heat and water. There is not general agreement on the relative stability of PMA and PTA colors to sunlight. It is an established fact, however, that PTMA colors are superior to either single complex acid type alone in their stability to sunlight.

The principal uses for PMA and PTA colors are in the field of printing inks. Other important applications include tinting and shading of white paper, in water colors, show card inks, in wax crayons, in the manufacture of colored paper, and in enamels for children's toys.

There are 22 references to the literature.—WHC

Uses of Polyvinyl Pyrrolidone

Anon. *Dyer* 115, 195-6, February 3, 1956.

A new stripping agent for textile dyes has been recently introduced. It is a solution of polyvinyl pyrrolidone and is marketed as a pale liquid product, viscous in character, which may be diluted with water. It is nonionic and is claimed to have excellent stability in hard water and the usual conditions of acidity and alkalinity associated with textile dyeing. It should not, however, be used in the presence of highly concentrated caustic soda (eg, mercerizing liquor).

The product exerts a strong attraction for dyes of many types, ie, vat, sulfur, and certain direct dyes, and its action is to produce conditions in which the dye is preferentially adsorbed on to the stripping agent. The complex formed between the dye and the polyvinyl pyrrolidone (PVP) is of sufficiently high stability to prevent redeposition of the dye on to the fiber. Although it is not usually recommended for use as a leveling agent, it can, owing to this pronounced affinity for dyes, be used as a retarding agent in special cases.

It is claimed that an excellent strip of vat dyeings or prints can be obtained by adding PVP to the usual caustic and hydrosulfite bath. A temperature of 85-95° C is recommended. A hot water rinse should follow the stripping operation.

Sulfur-dyed goods may also be stripped in the same manner, except that the temperature is usually somewhat reduced.

Direct-dyed materials are stripped with PVP alone, or with the further addition of sodium carbonate and Glauber's salt.

The new product is also recommended as an addition to the wash-liquor in washing prints of direct dyes or white discharges on direct-dyed grounds, to prevent staining of the white areas.

Other uses for PVP mentioned by the author are as a size additive and as a dyeing assistant with acetate dyes.—WHC

Recent Progress in the Dyeing of Terylene Polyester Fiber

Fern, A S and Hadfield, H R. *J Soc Dyers Colourists* 71, 840-55, December, 1955

The authors first discuss the application of disperse dyes, and state that the initial difficulties experienced in dyeing Terylene were due to the low rate of diffusion of these dyes into the fiber, compared with acetate and nylon. To speed up the rate of diffusion, the addition of carriers to the dyebath is recommended, also dyeing at elevated temperatures (above 100° C). The authors point out that as the result of this low rate of diffusion the wet fastness of disperse dyes on Terylene is superior to that on acetate or nylon.

The rate of diffusion of disperse dyes into Terylene varies widely from dye to dye. Those with the highest diffusion rate will build up most readily to deep shades.

In general, the lightfastness of disperse dyes on Terylene is about the same as on acetate, and definitely higher than on nylon, the difference being much more marked with azo disperse dyes than with anthraquinone disperse dyes. It is pointed out that certain carriers can seriously affect the lightfastness of many dyes.

The authors describe a number of carriers now being used in dyeing with disperse dyes in America and the United Kingdom, and compares their relative efficiency, toxicity, levelness, etc.

They also describe the application of Azoic dyes to Terylene by combining in one dyebath the dispersed free base and the dispersed coupling component, followed by treatment with nitrous acid, and give in much detail the results of their researches on this process. They state that the Azoic range of dyes represents a very valuable method of dyeing Terylene, but that much information is still required before the range of colors is increased, and before greater reproducibility in color and fastness properties is realized.

The dyeing of Terylene-wool blends is also discussed. All disperse dyes stain wool, and such stains are not easily removed, and the resulting dyeings have poor wet fastness. The authors describe various methods which have been proposed for dyeing these blends, including several published in the U.S. Further work is necessary, they believe, before the problem can be considered solved.

Thirty-two references to the literature are given.—WHC

Kier Boiling

Garrett, C J. *J Soc Dyers Colourists* 71, 870-6, December, 1955.

The purpose of this paper is to suggest standardized conditions of operation which from the author's experience are essential to good kier-boiling practice in all types of kiers.

He points out that the object of kier-boiling is to give uniformity of scouring, so that the fabric can be made white with the minimum quantity of oxidizing agents. In addition, there is a very important factor—the cloth must not be chemically damaged during the process.

The measurement of chemical attack is best obtained by the fluidity test, and the author recommends taking samples for this test from the top, middle and bottom of every kier of cloth.

He discusses the causes of tendering produced during the kier boil, particularly as the result of air, drawn into the kier during the plaiting of the cloth, which in the presence of caustic alkali produces oxycellulose. He states that a mechanically-filled kier will contain more air than a hand-filled kier.

He suggests the following conditions which should be observed:

1) The kier must not be overloaded with cloth.

2) The filling of a kier with cloth has a great bearing on the efficiency of the boil, and requires great care.

3) The rate of circulation must not exceed the rate of percolation.

4) The quantity of liquor used should be proportional to the amount of cloth.

5) The temperature of the steam used for heating the circulating liquor must not be too high.

6) Thermometers should be fitted to kiers to enable the temperature of the circulating liquor to be taken.

7) The kier should be well insulated to prevent heat losses by radiation. The author goes into great detail in describing the kier-boiling operation from start to finish.—WHC

• PATENT DIGEST •

PAUL WENGRAF

DYEING DACRON IN BLACK TO NAVY SHADES——— Diazocompound and Coupler Applied in Separate Steps

C,4,07

USPat 2,727,803 (Du Pont——Larson——Dec 20, 1955)

The preamble to this patent discusses a method for dyeing terephthalate fibers black-to-navy blue shades by applying mixtures of the diazotizable amine and the naphthol coupling agent in the first bath, followed by diazotizing in a second bath. This process, covered by Brit Pat 629,452 (Imperial Chemical Industries), caused considerable tarring, according to an article by Waters in *J Soc Dyers Col 66*, 614 (1950). Contamination of the dyeing equipment and dyeings of poor crocking fastness have been observed.

An elimination of these troubles is claimed when the dyeing process is conducted in three separate steps. First, the goods are treated at elevated temperatures (eg, above 185° F) with an azodiarylamine, optionally in the presence of a carrier, such as o-phenylphenol, and a dispersing agent, such as an alkyl aryl sulfonate, and rinsed. The second step comprises a similar treatment with a dispersed coupling agent (2-3-hydroxy-naphthoic acid). Finally, the bath is drained, and after the rinsing operation the acid nitrite solution is applied, preferably at elevated temperature.

The diazotizable azodiarylamine has the general formula

wherein "R-NH_2" stands for one of the customary arylamine compounds, such as aniline, toluidine, etc. X and Y are either H or methyl. An example is the compound obtained by coupling p-nitraniline with α-naphthylamine, followed by reduction of the nitro group.

Example: a fabric woven from polyethylene terephthalate (Dacron) staple yarn was immersed in water of 120°F; a paste consisting of the above-mentioned azodiarylamine, a small amount of dodecyl benzene sulfonate, phenylphenol and some water were added. After being dyed at the boil for 1.5 hrs the fabric was rinsed cold, then at 120°F, and thereupon treated at the boil for one hour with a solution of 2-3 hydroxynaphthoic acid, containing a dispersing agent. The bath was drained and diazotization was carried out at 190°F for one half hour. No tarring troubles were noted. A deep black of excellent fastness properties resulted.

Among the references cited by the Patent Office:

USPat 1,844,350 (Celanese/1932): dyeing of cellulose acetate by applying dispersions of hydroxy naphthoic acid arylides and diazotable amines either in one bath or two separate baths, and subsequently developing by diazotization.

USPat 2,048,786 (Celanese 1936): coloring of cellulose acetate by applying a dispersion of a napthoic acid derivative in free state plus a diazotable amine, and diazotizing in a second bath.

USPat 2,343,995 (Celanese/1944): obtaining dark azo colors on cellulose acetate by using as specific coupling components aniline derivatives containing an ether group in m-position to the amino group.

Brit Pat 609,943 (Imperial Chemical Industries): dyeing of Terylene fibers with disperse (acetate) dyes containing diazotable groups (eg, Dispersol Diazo Dyes) in the presence of a swelling agent, such as phenols, aromatic amines, etc, followed by diazotizing and coupling.

Waters, in *J Soc Dyers Col 66*, 614 (1950), points out the difficulty of dyeing Dacron fibers with Dispersol Diazo Black 2BS, PF in a dark navy blue because of its tendency to cause tarring in the dyebath when added to 2-hydroxy-3-naphthoic acid.

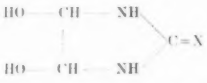
CREASEPROOFING OF TEXTILES ——— Treatment with Imidazolidone Derivatives

G,2,04

USPat 2,731,364 (Badische Anilin- & Sodafabrik——Reibnitz et al——Jan 17, 1956)

Methylol compounds of low molecular nitrogenous bases, such as urea, thiourea, guanidine, etc, are employed customarily for creaseproofing, shrinkproofing, swellability reducing or otherwise improving textile fibers.

The current invention advocates, for the same purposes, the use of imidazolidone derivatives, eg, 4-5-dihydroxy imidazolidone



(wherein X stands for O, S or NH)

transformed by formaldehyde into the corresponding mono- or dimethylol compounds.

Textiles can be impregnated either with the ready-made methylol compounds (described in an application of the same inventors of the same day) or by applying a solution of dihydroxy imidazolidone and formaldehyde and forming the methylol compound *in situ* in the fiber. The examples refer to the use of compositions of the first-mentioned type. In any event, the resin-forming aqueous solution must contain a potentially acid catalyst, such as an ammonium salt (nitrate or phosphate), also (optionally) other aminoplast-forming bases, eg, urea or melamine, or ingredients apt to improve the water resistance of the finish, eg, paraffin, zirconium salt emulsions, etc.

Impregnated goods are dried at low temperatures (40-85°C), then cured at 110 up to 140°C. A special modification of this process produces a wash-fast chintz or embossed-calender finish. This is done by subjecting the fabrics, dried at low temperature but not yet cured, to a calendering high-pressure treatment and then to higher temperatures to make resin condensation complete.

Example: a staple-fiber fabric was impregnated with a solution of monomethylol-4-5-dihydroxy imidazolidone, containing catalytic amounts of ammonium nitrate and ammonium acetate, squeezed and dried at 70°C. and finally heated to 120°C. A durable creaseproofing effect is reported.

The resin-treated materials are claimed to have improved abrasion resistance and no objectionable odor. The treating solutions are said to be very stable, even after addition of the catalyst.

References cited by the Patent Office:

USPat 2,504,857 (Bancroft & Sons/1950): obtaining a crease-resistant finish by applying a mixture of methylol and methylated methylolmelamines [cf *Am Dyestuff Reptr 39*, 524 (1950)].

USPat 2,574.114 (Bozel-Maletra/

1951): reducing the swelling power of cellulosic materials by a treatment with urea, partly condensed with glyoxal and partly with formaldehyde [cf *Am Dyestuff Reptr 42*, 306 (1952)].

USPat 2,588,640 (Bozel-Maletra 1952): adding higher monovalent alcohols to resin preparations of the type described in the preceding reference to improve the hydrophobic effect [cf *Am Dyestuff Reptr 42*, 506 (1952)].

DURABLE FINISHES——— Styrene-Maleic Anhydride Copolymers, Insolubilized with Metal Salts

G.2.01

USPat 2,698,264 (Monsanto Chemical Co——Niles——Dec 28, 1954)

This invention aims to impart durable finishes to textile materials, eg, spun rayon, by impregnating with water-soluble alkali, ammonium or amine salts of copolymerized styrene-maleic anhydride, followed by precipitating with a dilute solution of a metal salt. Water-soluble metal salts may be applied also in an initial bath, and the fabric subsequently impregnated with the copolymer solution, whereupon precipitation within the fibers occurs. Water-insoluble salts are first dispersed in the aqueous solution of the copolymer and then padded on in a one-bath process. Best results are said to be obtained by depositing 1-7% of the salt of the copolymer and an amount of 10-30% metal salt (calculated from the weight of the copolymer).

Satisfactory results reportedly are obtained by drying; a heat-curing treatment at 180-300°F is preferred.

All classes of metal salts can be used in this process, but the insoluble salts of group II A (Be, Ca, Mg, Ba) are preferable. According to the additional effect desired, copper salts can be applied for fungus-proof finishes, aluminum or zirconium salts for water-resistant effects, and so on. The claims protect the use of calcium carbonate only. This is illustrated by example III. A 7% solution of the ammonium salt of a styrene-maleic anhydride copolymer (1000 p) is mixed with powdered calcium carbonate (20 p) and ball-milled for 24 hrs. Samples of spun rayon fabrics or cotton sheeting are padded in the dispersion, leaving 7% solids in the fibers. After a period of drying at 200°F and curing at 280°F a stiff, wash-fast finish results.

Among the references cited by the Patent Office:

USPat 1,976,679 (I G Farben/1934): application of water-soluble polymeric acrylic acid derivatives (also of styrene-maleic acid copolymers) plus insoluble coloring pigments for various finishing, coating, etc, processes.

USPat 2,356,879 (Pense et al/1944): producing a lustrous coating for artificial leather, paper, oil cloth, etc, by impregnating with water-soluble alkali amine or ammonium salts of various copolymers of acrylic, maleic, vinyl type (also styrene-maleic anhydride copolymers) in combination with metal oxides, dyestuffs and many other substances.

WATER-REPELLENT FINISH ———Alkylaryl Glycol Ethers, Condensed with Quaternaries

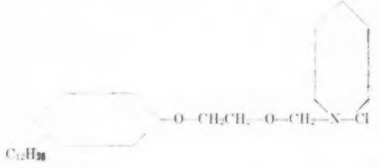
G.2.02

USPat 2,693,430 (General Aniline & Film Corp ——Cross, Mayhew——Nov 2, 1954)

USPat 2,554,441, copending with this patent, protects the manufacture of dispersing, wetting and emulsifying agents prepared by condensing alkyl-substituted aromatic glycol ethers with tertiary bases. Cation-active surfactants, yielding aqueous colloidal solutions, are obtained.

According to the present patent these compounds prove to be efficient water-repellent agents provided that the alkyl substituents (one to three) consist of chains of 8 to 18 C-atoms. In applying them in aqueous dispersion, squeezing, drying the fabrics at moderate temperature and curing at 120-160°C, durable effects can be noted, reportedly withstanding washing and drycleaning operations. The compounds are prepared by reacting the halomethyl ether of the alkylsubstituted aryl glycol ether with a tertiary base, preferably in excess, eg, with pyridine, benzyl dimethylamine, etc, either with or without an organic solvent.

Example: dodecyl phenoxy ethoxy chloromethane is condensed with pyridine; excess pyridine is removed in vacuo. A thick, waxy, water soluble product of the formula



is formed, giving, under the above conditions, a water-repellent finish which is said to be permanent to drycleaning and laundering.

References cited by the Patent Office:

USPat 2,115,250 (Rohm & Haas/1938): capillary-active compounds in general are obtained by condensing alkylphenols with dichloro diethylether and then with amines, optionally quaternized.

Brit Pat 477,991 (Imperial Chemical Industries/1938): hydrophobing cellulosic material by impregnation with condensates of stearamide, paraformaldehyde and pyridine, drying and baking (Velane).

Brit Pat 484,906 (I G Farben/1938): aromatic compounds are reacted with halogenated hydroxy alkyl ethers and subsequently with ammonia or an amine; the final products are surfactants in general.

STATIC PREVENTION——— Dispersions of Polymerized Quaternary Salts Containing Acrylic Chains

G.1

USPat 2,694,688 (Du Pont——Hughes——Nov 16, 1954)

The preamble to this patent states that none of the numerous antistatic agents known in prior literature proved to be entirely satisfactory: they were neither sufficiently effective nor resistant to washing or drycleaning.

The problem has been reportedly solved by applying aqueous dispersions containing the following components:

1) a water-soluble polymeric ammonium salt wherein an acrylic chain is linked to N, besides three lower alkyl and one oxyalkyl chain. An example is the polymeric β-methacrylyl-oxyethyl-diethyl-methyl ammonium methylsulfate.

2) a water-soluble salt of a higher alkyl sulfate (sodium hexadecenyl sulfate).

3) an aliphatic alcohol mixture (2-12 C, average 3-5 C-atoms), eg, ethanol plus octanol.

4) a mixture of monocyclic terpene hydrocarbons derived from turpentine.

These ingredients are dispersed in water to leave from 0.25 to 0.9% of the above-mentioned methylsulfate salt on the treated textiles.

The composition is said to give a durable antistatic effect, particularly on synthetic textiles.

Reference cited by the Patent Office:

USPat 2,626,876 (Am Cyanamid/1953): a quaternary ammonium compound, one of the substituents being a higher alkylamido group. The composition is used as an antistatic agent for vinyl resins.

News of the Trade

New Olin Mathieson Expansion Program in Chlorine, Caustic Soda

A $7,500,000 expansion program to double electrolytic production of chlorine and caustic soda at the McIntosh, Ala, plant of Olin Mathieson Chemical Corporation was announced this month by John O Logan, vice president and general manager, Industrial Chemicals Division.

The expansion will increase the plant's capacity to 250 tons of chlorine and 280 tons of caustic soda per day. Construction, which is already under way, is being handled by the Blaw-Knox Company, with completion scheduled for January, 1957.

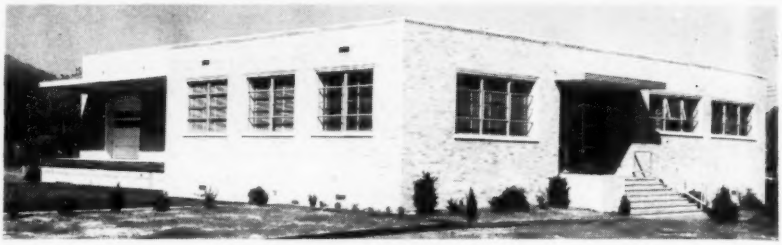
The new addition will be equipped with 124 Mathieson stationary-type mercury electrolytic cells. The cells produce chlorine, caustic soda and hydrogen by passing an electric current through a solution of common salt.

The company also announced that it is building barge docking and loading facilities on the Tombigbee River adjacent to the McIntosh plant. These will be in operation by late summer of this year and will permit shipments by water from the plant to river destinations, the Gulf of Mexico and beyond.

The plant is presently supplying chlorine for water purification and sewage treatment to municipalities throughout the South and to industry for use in textile and paper bleaching and in the manufacture of chemical products. The caustic soda produced is used primarily by the Southern rayon, paper, petroleum and chemical industries.

The McIntosh operation is one of three major Olin Mathieson plants producing electrolytic chlorine and caustic soda. The other two are at Saltville, Va, and Niagara Falls, N Y. Caustic soda by the lime-soda process is also manufactured at Saltville and at Lake Charles, La. The company additionally markets chlorine and caustic soda produced at the Huntsville Ala, plant of National Distillers Products Corporation; caustic soda produced at the Anniston, Ala, plant of Monsanto Chemical Company; and chlorine produced at the Arvida, Que, plant of Aluminium, Ltd.

Your attention is called to the fact that the *Colour Index* number shown in the Zinsser & Co advertisements in the April, 1956 issues of ADR was erroneously shown as *CI* 1087, whereas it should have read *CI* 1078.



Giegy Dyestuffs' Chattanooga Office

Geigy Opens Chattanooga Office

Geigy Dyestuffs, Division of Geigy Chemical Corp, 89-91 Barclay St, New York N Y, has announced the official opening of a second office in the South at 1208 East 23rd St, Chattanooga, Tenn. Previously the entire southern territory was serviced from the Geigy office at Charlotte, N C.

The new office, laboratories and warehouse set up in Chattanooga are especially adapted to the industries in that area which they serve. Geigy officials point out that the most modern equipment, methods and procedures have been made available and the service to the district will be improved greatly, as will the service of delivery.

The Chattanooga office, laboratories and warehouse will be under the direction of E V Helms, who, for over 10 years, has made his residence in Chattanooga.

Helms

This Chattanooga development followed the move which is still to be made by the main office in late summer or early fall when the Corporation's entire administrative and laboratory activities will be relocated in Ardsley, New York on a 45-acre tract. These new facilities, which represent only the start of a well-planned development, reportedly will cost in the neighborhood of $4,500,000. Further developments planned are in connection with Pharmaceutical Research Laboratory. When this development is completed, all divisions —Geigy Dyestuffs, Geigy Agricultural Chemicals, Geigy Pharmaceuticals, Geigy Industrial Chemicals, as well as administrative and executive offices, laboratories, both research and application, as well as developmental and production divisions will be in one central location. The Corporation will continue its manufacturing divisions at McIntosh, Ala and Cranston R I, as well as its interest in the Toms River-Cincinnati Chemical Corp of Toms River, N J and Cincinnati, O. Sales and service branches of the Corporation will continue to be maintained at Philadelphia; Charlotte; Chattanooga; Chicago; Los Angeles; Portland, Ore; Newton and Toronto. Only recently the Boston-Providence offices were consolidated in the New England branch at Newton Upper Falls, Mass.

Nopco and Metasap Plants to Shut Down For Two Weeks

The plants of the Industrial Manufacturing Division of the Nopco Chemical Company and its subsidiary, the Metasap Chemical Company, will shut down for two weeks this summer.

The plant in Cedartown, Ga, will be closed from July 1 through July 15 and the Harrison, NJ, plant from August 12 through August 26.

Nopco and Metasap customers have been urged to place their orders well in advance so as to avoid delays in shipping during the vacation periods.

Hope Chemical Adds New Drycleaning Personnel

R L Bernstein, former head of Geigy's drycleaning department, and now director of technical sales & service of Hope Chemical Corporation, has announced that, through an exclusive arrangement with the Geigy Chemical Corp, their drycleaning technical sales and service personnel have become part of Hope, which specializes in drycleaning chemical specialties.

GE Acquires New Tract Adjacent to Silicone Products Dept

The acquisition of more than 60 acres of land adjacent to the Silicone Products Department of the General Electric Co at Waterford, N Y, has been announced.

Charles E Reed, general manager of the department, explained that the land was obtained to provide adequate room for an orderly, planned expansion of production, research, and administrative facilities to meet the increasing industrial and consumer demands for silicones. The latest land transactions will bring the over-all plant site to more than 160 acres.

The Waterford plant is a completely integrated silicone production unit, making basic chemical intermediates and silicone gums, rubbers, resins, emulsions, and specialties. Its capacity has been increased several times since production of silicones was started in Waterford in May, 1947.

The silicone operation attained independent status as a full-fledged operating department in January, 1952 and is one of six departments in G-E's Chemical and Metallurgical Division.

Except for its sales force and agents, which distribute silicone products in all sections of the United States, the Silicone Products Department conducts its entire operation at Waterford. However, extensive basic research in silicones is conducted at the General Electric Research Laboratory at The Knolls, Schenectady, N Y.

Raymond Labs Enters CPI

Raymond Laboratories, Inc has announced their entrance into the commercial field. Twenty-year specialists as cosmetic chemists, the St Paul, Minn, firm is making available from stock commercial quantities of sodium lauryl sulfate, quaternary ammonium compound, and thioglycolic acid and its salts.

New product applications, particularly in the industrial field, are being tested in Raymond Laboratories' PR&D department. A new processing plant for sodium bromate, due on stream this month, will add another product to Raymond's list of industrial chemicals.

Hatch

Hatch Textile Research Marks 30th Year

Hatch Textile Research, Inc, New York, N Y, celebrated its 30th anniversary on May 1st, the firm having been founded in 1906 under the name Hatch and Reutlinger.

The laboratory serves wholesale, manufacturing, converting and retail organizations in quality control, testing and handling of consumer and inter-trade complaints.

Herbert H Hatch, president, has been in the textile industry since 1908.

N Y Alumni of LTI Elect Liebmann Chairman

Herman Liebmann, president of A Steinam Co, Inc, was elected chairman of the New York Chapter, Lowell Technological Institute Alumni Association during the Chapter's Spring meeting on April 24 at the New York Athletic Club. He succeeds Lathrope A Schiffer, Deering Milliken & Co, Inc.

Mr Liebmann headed the following slate of officers, which was accepted unanimously: *vice chairman*—Charles A Whitehead, Howes Publishing Co, Inc; *treasurer*—Roger J Murphy, Timely Clothes Inc; *secretary*—Joseph C Morris, Burlington Mills. The following committee chairmen also were named: *Advisory*—A Chester Clifford, Western Electric Co; *Nominating*—James G Pottinger, Reliance Mfg. Co; and *Program*—Richard M Meltzer, Berglas Riegel Co.

Featured speakers of the evening were Charles W Dorn and P J Fynn, director and assistant director of the Research Laboratories, J C Penney Co, who shared the podium for a presentation on "Operation Cue—The Effects of an Atom-Bomb Blast on Textiles and Clothing." The presentation was highlighted by colored slides and a film taken at the blast site in Nevada in 1955.

LTI president Martin J Lydon, athletic director Lester H Cushing, and national alumni representative Elmer E Fickett also addressed the group.

General Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
Gordon Research Conferences—Textiles Program, July 9-13, Colby Junior College, New London, N H.

AMERICAN ASSOCIATION FOR TEXTILE TECHNOLOGY, INC
June 6, Sept. 5, Oct 3, Nov 7, Dec 5 (All meetings at the Vanderbilt Hotel, New York, N Y).

AMERICAN SOCIETY FOR TESTING MATERIALS
June 17-22—59th Annual Meeting and 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N J; Sept 16-22—2nd Pacific Area National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif; Oct 16-19—Fall Meeting of Committee D-13 on Textiles, Warwick Hotel, New York, N Y.

THE DRYSALTERS CLUB OF NEW ENGLAND
June 22 (Outing Wachusett Country Club, West Boylston, Mass)

THE FIBER SOCIETY
Fall Meeting—Sept 6-7, Warwick Hotel, New York, N Y. Spring Meeting — May 1-7, 1957, The Clemson House, Clemson, S C

THE INSTRUMENT SOCIETY OF AMERICA
11th Annual Instrumentation-Automation Conference and Exhibit—Sept 17-21, New York Coliseum, New York, N Y

LOWELL TECHNOLOGICAL INSTITUTE
May 19 (Alumni Day); June 17— (Baccalaureate and Commencement Activities); Sept 26-28 (Perkin Centennial observance and open house). All events on campus at Lowell, Mass

PERKIN CENTENNIAL
September 10-15. Waldorf-Astoria Hotel, New York, N Y.

PHILADELPHIA TEXTILE INSTITUTE
June 14 (Annual Meeting and Clambake—6 pm—College Campus, Germantown, Pa); June 15 (Outing—Manufacturers Golf & Country Club, Oreland, Pa); June 16(Commencement—College Campus—11 am).

THE QUARTERMASTER ASSOCIATION
Annual Convention—Oct 27-28, Conrad Hilton Hotel, Chicago, Ill.

QUEBEC SECTION, CANADIAN ASSOCIATION OF TEXTILE COLORISTS AND CHEMISTS
June 16 (Annual golf tournament).

SOUTHERN TEXTILE EXPOSITION
19th Exposition, Oct 1-5, Textile Hall, Greenville, S C.

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
June 12, Sept 11, Oct 9, Nov 7 (Palm Terrace Suite, Hotel Roosevelt, New York, N Y).

TEXTILE TECHNICAL FEDERATION OF CANADA
5th Bi-annual Textile Seminar—June 5-7, Queen's Univ, Kingston, Ont.

• NEW PRODUCTS AND DEVELOPMENTS •

New Method For Recovery of Chromic Acid Solutions

A patented method for recovering contaminated or spent chromic acid solutions typical of chromium plating, anodizing and copper stripping operations has been developed by the Mutual Chemical Division of Allied Chemical & Dye Corporation, and is being made generally available for industrial use without the requirement of any formal license. U S Patent 2,733,204 was recently issued covering this method.

The process involves ion-exchange treatment for removal of metallic contaminants of iron, copper, aluminum and other metals by passing solutions through a cation-exchange resin consisting of a sulfonated infusible polymerizate of a polyvinyl aryl compound. Such treatment on a hydrogen cycle permits recovery of baths which become inoperable due to excessive metallic contamination or reduction in acidity.

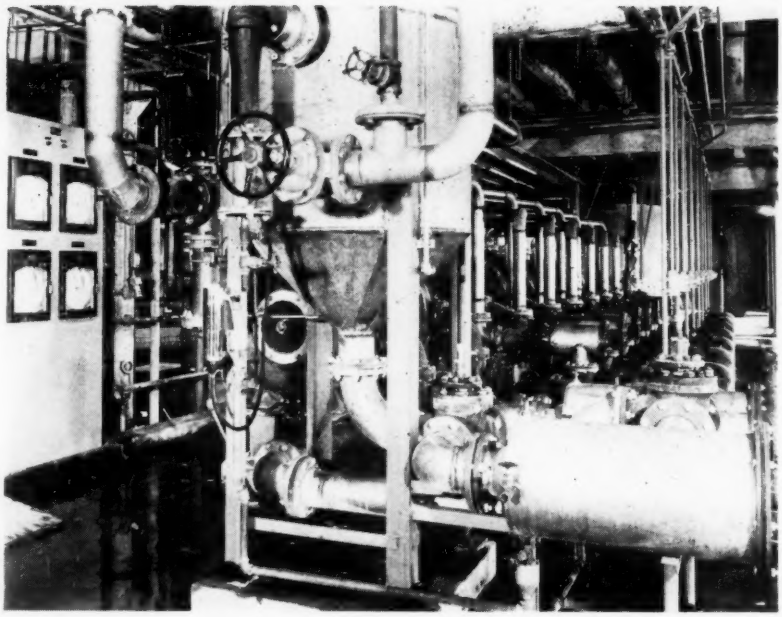
In relatively large operations the method is considered a useful engineering tool not only for decreasing the cost of chromium chemical treatments, but as a means of reducing costly waste treatment necessitated by increasing emphasis on eliminating stream pollution. Furthermore, it has been reported that the quality of plated and anodized work is improved by the use of these so-called decationized solutions. A number of companies are understood to be using this process and the necessary equipment can be obtained from several engineering concerns.

Artisil Scarlet GFL Ultradispersed

Artisil Scarlet GFL Ultradispersed has been made available for sale by Sandoz Chemical Works, Inc. It reportedly dyes acetate in brilliant yellowish scarlets possessing exceptional light and wet fastness. Dyeings also are said to show outstanding fastness to gas fading and sublimation.

Artisil Scarlet GFL Ultradispersed dyes nylon, polyester and acrylic fibers, high-temperature processes giving the best results on the latter. The shade on nylon is bluer than on acetate. Triacetate fiber reportedly is dyed fast to light and washing, dyeing at the boil being the preferred method.

Circular No. 1221 on the subject is available from all Sandoz offices.



New Dorr-Clone installation at Indianapolis plant of National Starch Products Inc, improves the continuous separation of protein and starch.

New Plant Installation Improves Starch Quality

It is reported that starch of the highest purity is now being produced at the National Starch Products' corn refinery at Indianapolis, Ind. Due to a new method of separation, the residual protein content has been reduced substantially.

According to R W Merritt, vice president of manufacturing, the installation at the Indianapolis plant of Dorr-Clone separators initiates the first 100% commercial installation in a corn starch refinery in the United States.

The Dorr-Clone units separate the starch from the gluten (protein) by a cyclonic process, which, in action, is similar to a miniature hurricane with the starch and gluten forced through tapered tubes under pressure. In the center of each tapered tube, a vortex forms in which there is no disturbance, thus permitting a clean separation of the two materials. The whole system is totally enclosed, all metal parts including pumps, pipes, and other accessory equipment are constructed of stainless steel and the operation is fully instrumentized, reportedly resulting in a high degree of cleanliness and assuring an extremely close control.

The Dorr-Clone installation is another step in National's four-million dollar expansion program.

Wicaset EHF

Wica Chemicals, Inc, Charlotte, N C, has developed a new, special-purpose, film-forming emulsion of the acrylic type, which is now in production.

The polymeric material fuses at 250° F to form a tough, strong film that is said to be resistant to hot oils, boiling water, light and heat effects.

Marketed as *Wicaset EHF*, the resulting film is reported to be tasteless, odorless and flexible. Furnished as a 50% solids emulsion, it may be applied by spraying or impregnating or thickened for roller coating.

Cravaco APS

A new silicone emulsion, designed for use in "wash-and-wear" finishes, has been announced by The Cravenette Company, USA, Hoboken, N J.

Cravaco APS is said to be compatible with the various types of resins used in "wash-and-wear" finish formulations and to aid in making those finishes more effective when properly applied to a variety of textile fabrics.

Such additional features as increased resistance to wear by abrasion, increased tensile strength, and very rapid drying are claimed to be imparted to the fabric, in addition to the other points in favor of "wash-and-wear" finishes. Cravaco APS is a one-package product.

New Avisco Products Announced

Culminating an extensive research program in the field of crimpable fibers, American Viscose announced on May 7th a new textile filament which is expected to have new and interesting market possibilities. As described at the annual meeting of stockholders, the new product is handled as a regular fiber, but it develops a permanent crimp when wet with water. It has been made in pilot plant and is now being put into commercial production.

In describing projects at the Research and Development Division, Herschel H Cudd, vice president, mentioned work on a super-strength tire yarn, now in commercial production; experimental work with a new viscose textile filament, spun-dyed for carpets; an improved rayon staple with greater wet strength for industrial uses; and the expansion of the color range in spun-dyed acetate yarns. He also said that several new coatings have been developed for Avisco cellophane, widening the use of this film for packaging.

A new fibrous rubber product is about ready for semicommercial production, Dr Cudd said, stating that the greatest end use developed to date for this product is as a rug underlay. Other end uses for this porous, nonskid, tear-resistant material are being explored.

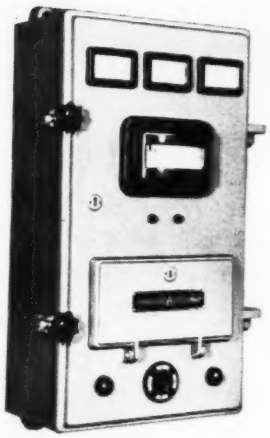
Walter E Scholer, manager of the corporation's Fabric Development Department, described the operation of the Avisco Originals program to increase the use of rayon and acetate in the fashion field.

Rockflux

A new product has been developed to resist the attack of acids, alkalis, water, oil, and grease, with Rockflux, a practical finish for application over new, wet concrete, or for patching or resurfacing old floors at ½" of more.

This material is claimed to have three times the compressive strength and four times the serviceability of concrete. The manufacturer states that Rockflux makes a perfect bond to old concrete—making ½" patching or resurfacing practical and permanent. The material is easy to apply and comes ready mixed in balanced proportions under laboratory control, requiring only the addition of water. It reportedly sets in 24 hours, and is shipped in 100-lb water-proof bags.

For further information write Flexrock Co, 3606 Filbert St, Philadelphia 1, Pa.



Textometer

The Textometer automatically controls moisture content of fabrics and warps emerging from textile dryers and slashers. Manufactured by the Mahlo Electro-Mechanical Works, Germany, it is being introduced in the United States by Cosa Corporation, 405 Lexington Ave, New York 17, N Y.

When installed with slashing machine tenters or other dryers the Textometer is said to automatically control the speed of the machine so that emerging material always has the desired amount of moisture. Deviation from set moisture percent is corrected without overcompensation. It is stated that Textometer Automatic Speed Control permits faster machine speed, greater production, and more efficient steam consumption and power utilization, while freeing the operator for other duties.

Textometer operation is based on the close relationship between the moisture content of a given textile and its electrical conductivity. Electrodes, in the form of rollers or feeler units, contact the textile and transfer conductivity readings to the Textometer, where the corresponding moisture value is indicated. It is stated that readings are not noticeably affected by differences in weight, thread count or yarn number of the material. When deviation from pre-set moisture content occurs, control signals change machine speed by means of a pilot motor.

The Automatic Control Unit may be blocked off during shut-down or low-speed periods. After restart, the speed increase can be locked out until overdried material leaves the dryer. The Textometer is also available without the Automatic Control Unit, in which case the operator regulates machine speed by hand. He bases his action on a scale calibrated in moisture percent, and on green, red and yellow signal lamps which indicate, respectively, "dry," "normal" or "moist" conditions. A recorder can be installed to record drying action over a period of time.

National Carbanthrene Direct Black 3G Double Paste

National Carbanthrene Direct Black 3G Double Paste is the latest addition to National Aniline Division's line of anthraquinone vat dyes.

This nondrying paste produces, on cotton and rayon, greenish-black shades. It reportedly may be dyed by the various pigment - impregnation methods as well as the reduced bath method, and is also said to be suitable for printing. National states that it is unaffected by the presence of metals in the dyebath and is suitable for use in all types of dyeing equipment. It reportedly exhibits maximum fastness to light in heavy shades, the highest AATCC rating, and excellent fastness to most wet processing, including cross dyeing, stoving, and perspiration.

This product is said to be suitable for the production of resin-finished dress goods and suitings, as well as materials that are subsequently to be rubberized.

Silver Lube RLS

Silver Lube RLS, a recent development of the laboratories of Carolina Aniline & Extract Co, Charlotte 1, NC, joins the list of silicone products which are exciting the textile and chemical industries.

Silver Lube RLS is a free-flowing white emulsion, reportedly soluble in all proportions and hydroscopic in nature. The particle size is under five microns. Contains 50% solids; 25% by weight of silicone. It might be called a "slurry" of microcrystalline waxes and silicone fluid.

It is reported to be compatible with all water-soluble sizes resins and gums. Neutral pH and stability to cold-water solutions is said to be excellent. It is nonpermanent and reportedly can be readily removed with a warm soap solution. Stability of bath is not broken by either high or low pH, it is claimed.

Further advantages cited by the manufacturer include no impairment of color value or lightfastness, nonoxidizing, and nonyellowing on age or under heat. It is claimed that, where lubricity is desired, the product is without peer.

Quoted price is 92c per lb, drum lots, fob Charlotte.

• NAMES IN THE NEWS •

James B Young, formerly with Glass Fabrics Finishing Corp, Cedar Grove, NJ, has joined Eureka Printing Co, Clifton, NJ, as superintendent of dyeing.

Instrument Development Laboratories, Needham Heights, Mass, has announced the appointment of **Donald R Hall** as sales engineer. Formerly with the Brown Instruments Division of Minneapolis - Honeywell Regulator Company, Mr Hall will act as sales engineer of IDL Color Measurement and Control Equipment.

Walter F Prien, captain, Supply Corps, U S Navy, has been assigned to the Philadelphia Quartermaster Depot, where he will assist in planning work being done for the anticipated single manager assignment for clothing and textiles to the Army.

Captain Prien has served for the past 2½ years as commanding officer of the Naval Supply Depot, Great Lakes, Ill, with additional duty as district supply officer of the 9th Naval District.

P C Blackman, president of Blackman-Uhler Co, Spartenburg, SC, a division of the Andover Co, has announced the appointment of three new members to its staff. **William A Coleman** and **Harry Lynn Parker, Jr** have joined the sales staff, and **A F Neister, Jr** has entered the Blackman-Uhler laboratory as a technician.

Prien

Coleman

Parker

Neister

Max E Bretschger (right), retiring president of FMC's Becco Chemical Division, Buffalo, NY, welcomes Frederick A Gilbert as new president of Becco, one of industry's largest producers of hydrogen peroxide and allied oxygen compounds.

Max E Bretschger has retired as division president of Food Machinery and Chemical Corporation's Becco Chemical Division. He will be senior technical advisor on peroxygen chemicals to the corporation.

Frederick A Gilbert, formerly vice president and assistant division manager of the Becco Chemical Division, succeeds Dr Bretschger to the presidency.

Dr Bretschger, a leader in peroxygen chemical technology for over thirty years, was born in Switzerland in 1884. He graduated from the Federal Institute of Technology in Zurich in 1908 and received his doctorate from the University of Zurich in 1910. Shortly afterwards he became production manager of one of the world's first electrolytic hydrogen peroxide plants, located in Switzerland. When Charles A Buerk founded the Buffalo Electro - Chemical Company, predecessor of the Becco Chemical Division, in 1925, Dr Bretschger was invited to come to the United States to supervise the construction of the Buffalo plant and manage its operation. After Mr Buerk's death, Dr Bretschger became president of the company.

WILLIAM R GUTEKUNST

William R Gutekunst, 49, in charge of dyeing operations for Interwoven Stocking Co, Martinsburg, W Va.

Mr Gutekunst was a graduate of La-Salle College and Philadelphia Textile Institute, and a member of AATCC.

He is survived by his widow, two sons, two daughters, a sister, and four brothers. Three of the brothers, Francis J, Ralph M and Edward A, are executives of Hellwig Dyeing Corp, Philadelphia.

The election of **Donald D Pascal** as executive vice president, succeeding the late **A A Halden,** and **William C Buffing** as treasurer of National Starch Products Inc, New York, has been announced by Frank Greenwall, president.

Mr. Pascal has been with National Starch Products throughout his business career, having joined the organization in 1929.

Mr Buffing was formerly controller of the company.

Robert A Gopel, formerly manager of sales personnel development, Koppers Company, Inc, has been appointed assistant sales manager, American Aniline Products, Inc.

Mr Gopel joined Koppers, which is the parent Company of American Aniline, in 1949 as director of sales training. He joined American Aniline early in 1956.

William B Amos has joined Wica Chemicals, Inc, Charlotte, NC, as sales technician.

Mr Amos's association is in anticipation of Wica's establishment of plant and warehouse facilities to serve the areas of Georgia, Alabama, and Tennessee.

Mr Amos has been with the Eagle & Phenix Division of Fairforest Co, Columbus, Ga, and as superintendent of dyeing and finishing for Jefferson Mills, Inc, of Jefferson, Ga. For the past three years he was associated with Stein Hall & Company as sales technician.

Pascal

Buffing

Gopel

Amos

TECHNICAL LITERATURE

(It is understood that the following literature is available from the sources listed in italics).

ANTIOXIDANT D FOR ODORLESS PAINTS, ENAMELS AND LACQUERS—*National Aniline Div. Allied Chemical & Dye Corp, 40 Rector St. New York 6, NY*—Bulletin (I-18) contains physical properties, covers suggested formulation methods and quantities to be used in odorless paints, varnishes and pigment inks. It also contains a performance table that shows the relative effectiveness of Antioxidant D in comparison with National Anti-Oxidant B and National ASA. —*4 pages.*

BIBLIOGRAPHICAL ABSTRACTS ON REDEPOSITION OF SOIL ON COTTON FABRIC—*$1.00, ASTM, 1916 Race Street, Philadelphia 3, Pa.*—Special Technical Publication No. 173 contains a review of the literature on the theory and practice of redeposition methods which was presented at a meeting of ASTM Committee D-12 on Soaps and Other Detergents, March 15, 1955. The review is a consolidation of the more pertinent information developed in the preparation of the bibliography which follows.

The bibliography itself contains 171 entries covering the period 1909 to 1953. References are numbered consecutively and are listed by year and author. Abstracts in many cases were prepared from the original article and are slanted toward giving an indication of the contents that are pertinent to testing methods and theories. Reference is made to abstracts appearing in *Chemical Abstracts* wherever possible.

The bibliography was prepared by a task committee of Subcommittee T-5 of Committee D-12 as one of its first steps in developing a method of measurement of the redeposition of soil onto fabric from aqueous detergent systems (laundering). It will be of benefit to detergent workers, particularly those just entering the field.—*32 pages. 6 x 9.*

DYEING, PRINTING, FINISHING AND HEAT-TREATING ARNEL AND ARNEL BLENDS—*Marketing Department. Textile Division, Celanese Corp of America, Charlotte, NC*—Through text, charts and diagrams, this bulletin presents technical information on Arnel.

Arnel, it is noted, not only possesses the beauty characteristics of Celanese acetate, but also incorporates certain unique performance qualities depending on how it is woven or blended. Through heat treating, for example, it is made resistant to stretching, shrinking and wrinkles, even in humid weather.

DYNAMASTER ELECTRONIC POTENTIOMETER AND BRIDGE INSTRUMENTS FOR RECORDING AND CONTROLLING — *The Bristol Co, Waterbury 20, Conn* — This two-color bulletin is divided into three main sections.

The first gives details of the instrument and its components, as well as the principles of operation. Full specifications are listed for the various models of recorders, and automatic controllers available. These include a 3- and 12-inch strip-chart and 12-inch round-chart recorders, and both air and electric control models. Single and multiple variable recorders are listed, as well as the new High-Speed Recorder.

The second section lists sensing elements and special attachments, such as resistance bulbs, magnetos, photocells, conductivity cells, and frequency converters, plus computing, telemetering, totalizing, and digital read out attachments.

The third section describes and illustrates other manufacturer's equipment in which Dynamasters have been incorporated, including strain gauges, viscosity meters, thickness gauges, and gas analyzers.

The 64-page bulletin, P1245A, is illustrated with more than 110 photos and drawings.

ETHERS AND OXIDES—*Carbide and Carbon Chemicals Co, 30 East 42nd St, New York 17, NY*—F-4764 discusses the applications of thirty-two products, including ethylene oxide and propylene oxide. It gives data on physical properties, solubilities, shipping, specifications and test methods, and constant boiling mixtures. Thirty-four physical property charts are also included. An important feature of the new book is a list of literature and patent references for individual compounds giving additional sources for more detailed information.—*64 pages.*

FACTS AND FIGURES—PROTECTIVE'S PLASTIC PACKAGING PRODUCTS FOR INDUSTRY—*Protective Lining Corp. 22 Woodhull St. Brooklyn 31 N Y*—This 20-page booklet contains much helpful information and many practical suggestions with regard to the flexible film liners, bags and specialties.

Sections include: "A look at Protective Lining Corporation . . . Manufacturing Technique"; "Types of Liners"— round bottom and straight bottom; "Why Liners"; "Liners are Used for . . ."; "Methods of Inserting & Closing Liners"; "Carton Liners"; "Bags"; "Special Liners"; "Polyethylene at a Glance . . ." "Special Covers"; and "Pallet Covers & Other Specialties."

A full-page table summarizes flexible films for packaging and laminates, covering for each material general characteristics, suitability for packaging, defects, MVT rate, temperature rate, and cost.

HOTEL TEXTILE PURCHASING GUIDE—*$7.50, American Hotel Association, 221 West 57th St, New York, NY*—Prepared for AHA by L A Bradley, laundry and textile consultant, this 111-page guide is expected to be of value as a reference book for other institutional consumers, manufacturers, suppliers and technical organizations as well as hotels.

Using newly-developed American Standard L24 Minimum Performance Requirements for Institutional Textiles, the guide shows in specific terms how the hotel and institutional purchaser may be assured of quality performance in textile purchases. The American Hotel Association, which estimates that hotels spend more than $100,000,000 a year on textile products sponsored the project to develop the L24 Standards compiled by the American Standards Association.

The purchasing guide covers sheets and pillowcases, bath mats, towels, table napery, bedspreads, blankets, shower curtains, awnings and canopies, curtains, draperies, slip covers, upholstery, aprons, overalls, work clothing and uniforms. The standards represent a consensus of the technical knowhow and trade experience of nearly 40 major concerns in the institutional field.

The purchaser is told in the case of each specific item that, to be assured of the protection of the L24 Minimum Performance Requirements, it is suggested that the following wording appear on all purchase orders for specific textile materials: "The draperies (for example) listed on this purchase order shall meet or exceed the American Standard L24.1.5."

Each specific textile item is covered in a sub section of the purchasing portion of the guide. The description and general remarks about the item are followed by "Suggestions for Purchasing" in which the above wording appears with other pertinent suggestions.

The second half of the Purchasing Guide has seven sections giving information about day-to-day activities in care and laundering of institutional textiles. The installation of a laundry (including detailed equipment recommendations) washing instructions, removal of stains, control, conservation and storage and labelling are some of the subjects given exhaustive treatment in the various sections. Check lists are included to aid in "bridging the gap between good intentions and positive action."

INDANTHRENE DARK BROWN MR INFRA PASTE—*General Dyestuff Co, 435 Hudson St, New York 14, NY*—Circular G-793 covers this new anthraquinone vat dyestuff, which has been developed "for dyeing deep, economical, reddish-brown shades very good to excellent fastness properties on cotton and rayon." Although this dyestuff is recommended by GDC for the production of attractive cocoa to spice-brown self shades, it is said also to be very useful as a strong and very economical brown component of fast combinations.

G-793 carries sections on fastness properties, working properties, uses, application, details, etc. Special sections are devoted to "dyeing" and "soaping dyeings." Sample dyeings and fastness ratings on full shades also are included.

MOLYBDENUM, URANIUM, VANADIUM AND TUNGSTEN CHEMICALS—*Millmaster Chemical Corp, 295 Madison Ave, New York 17, NY*—This 8-page brochure describes the various chemicals offered by the S W Shattuck Chemical Co, Denver, Colo.

N-HEXANOL — *Carbide and Carbon Chemicals Co, 30 East 42 St, New York 17, NY*—Discusses the uses for this intermediate and gives data on its physical and physiological properties, specifications, shipping, resin solubilities, and constant boiling mixtures.

N-SUBSTITUTED MORPHOLINE DERIVATIVES — *Carbide and Carbon Chemicals Co, 30 East 42nd St, New York 17, NY*—Discusses uses and potential applications, physical and physiological properties, and shipping data.

The N-substituted morpholine derivatives mentioned in this bulletin (F-8640) are: N-methyl morpholine, N-ethyl morpholine, N-(3-aminopropyl) morpholine, and N-phenyl morpholine.

PARAFORMALDEHYDE — *Heyden Chemical Corp, 342 Madison Ave, New York 17, NY*—Reports on properties and uses of this form of formaldehyde.

Heyden's paraformaldehyde (USP X) is supplied in three forms of different particle size: powder, medium powder and flo granular.

PROPERTIES, USES AND HANDLING OF HYDROGEN PEROXIDE — *Advertising and Sales Promotion Dept, Solvay Process Div, Allied Chemical & Dye Corp, 61 Broadway, New York 6, NY*—Illustrated with tables and diagrams, the text of the booklet covers some of the chemical reactions of hydrogen peroxide and suggests applications which include its use as a bleaching agent in the textile and paper industries, in the syntheses of organic and inorganic chemicals, in the manufacture of dyestuffs, as a polymerization catalyst and in many other industries and manufacturing processes.

In addition, the booklet describes in detail the storage, safe handling and unloading of hydrogen peroxide in drums, tank trucks and tank cars.

SUPPLEMENT TO AIR POLLUTION ABATEMENT MANUAL — *75¢; Manufacturing Chemists' Association, 1625 Eye St, NW, Washington 6, DC*—MCA has published this 32-page supplement (Manual Sheet P-7A) to Chapter 6 of the Air Pollution Abatement Manual, "Sampling Procedures and Measuring Equipment".

This supplement updates the information contained in the original chapter, which covered developments as of late 1951. Since then, many new sampling and measuring techniques have been developed and older techniques improved. These are discussed, as well as some of the original topics, described in greater detail. Also included are tables, diagrams and an extensive bibliography.

The entire Air Pollution Abatement Manual, prepared under the direction of the Air Pollution Abatement Committee of the MCA, consists of 12 chapters and costs $6.00 per copy.

TERGITOL SURFACTANTS—*Carbide and Carbon Chemicals Co, 30 East 42nd St, New York 17, NY*—Seven nonionics and four anionics are described. Besides the information on physical properties, shipping data, and specifications, performance data are included on wetting, penetrating, cleaning, and sudsing action, and lime soap dispersing power. Test methods used in obtaining performance data and specifications are given.—40 pages.

THE CHEMISTRY OF FATTY ACIDS—*Chemical Division, Armour and Co, 1355 W. 31st St, Chicago 9, Ill*—A comprehensive and convenient reference work for users of fatty acids and chemicals derived from fatty acids.

Composition of fats and oils is reviewed in the booklet, as are sources and chemical makeup of fatty acids. These naturally occuring fats and oils offer one of the largest potential sources of raw materials for the preparation of chemicals.

The higher members of the series, (lauric, myristic, palmitic, stearic, oleic, linoleic, etc) in chemical combination with glycerol, form the main constituents of the animal and vegetable fats and oils. The lower members (caproic, caprylic, capric) are not widely distributed in nature and form a minor constituent in only a few natural oils.

The preparation, characteristics and applications of these acids are outlined and a section is devoted to the handling of fatty acids in shipment, storage and use. Also included is a reference guide to test methods and analytical procedures, along with an explanation of terms used.

THE EFFECT OF CERTAIN PHYSICAL CHARACTERISTICS OF FABRICS UPON HEAT TRANSMISSION—*Lowell Technological Institute, 1 Textile Ave, Lowell, Mass*—This bulletin was prepared by David L Aelion, graduate student at LTI in 1952-3, and Prof Harry C Brown, chairman of the division of engineering.

WATER WASTES OF INDUSTRY—*20¢; School of Engineering, North Carolina State College, Raleigh, NC*—This 20-page bulletin (No. 5 of the Facts for Industry Series) has been prepared by Nelson L Nemerow of N C State's Department of Civil Engineering.

The author discusses origin of wastes and their effect on streams and sewage treatment plants; stream statutes in North Carolina; characteristics and accepted treatments of specific wastes, including those of the textile and laundry industries; and a recommended procedure for solution to waste disposal problems.

Specialitate

— RUMANIAN FOR

SPECIALIZATION

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